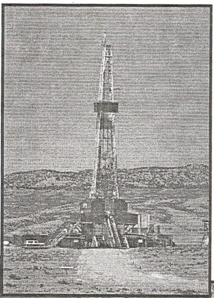
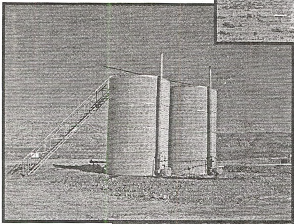
. Department of the Interior

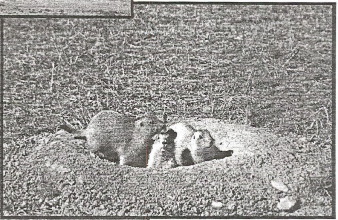
Bureau of Land Management
Rock Springs District Office

Pinedale and Green River Resource Areas July 1997

Draft Environmental Impact Statement
Jonah Field II Natural Gas Project







The Bureau of Land Management is responsible for the balanced management of the public lands and resources and their various values so that they are considered in a combination that will best serve the needs of the American people. Management is based upon the principles of multiple use and sustained yield; a combination of uses that take into account the long-term needs of future generations for renewable and nonrenewable resources. These resources include recreation, range, timber, minerals, watershed, fish and wildlife, wilderness, and natural, scenic, scientific, and cultural values.

BLM/WY/PL-97/015+1310

DRAFT
ENVIRONMENTAL IMPACT STATEMENT FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT, SUBLETTE COUNTY, WYOMING

Pinedale Resource Area
and
Green River Resource Area
Rock Springs District
Bureau of Land Management
Rock Springs, Wyoming

This Environmental Impact Statement was prepared by TRC Mariah Associates Inc., an environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management (BLM). The BLM, in accordance with Federal Regulation 40 CFR 1506.5(a) and (b), is in agreement with the findings of the analysis and approves and takes responsibility for the scope and content of this document.

July 1997

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT, SUBLETTE COUNTY, WYOMING

(X) Draft ( ) Final

U.S. Department of the Interior
Bureau of Land Management

Abstract:

This draft Environmental Impact Statement (EIS) assesses the environmental consequences of a proposed natural gas development project in south-central Sublette County, approximately 32 mi southeast of Pinedale, Wyoming. Public scoping commenced in mid-July 1996. All issues raised during scoping and interdisciplinary team preparation of the analysis are addressed. The proposed project entails the drilling, completion, testing, operation, abandonment, and reclamation of natural gas exploration and production operations by McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, Western Gas Resources, and other operators. The proposed project would use standard procedures as currently employed by other state and regional gas field developments. A maximum of 450 well locations and associated ancillary facilities, roads, and pipelines would result in the initial disturbance of approximately 2,254 to 2,919 acres on and adjacent to the 59,600-acre project area. Numerous standard, project-specific and site-specific mitigation measures would be employed to assure that project impacts are minimized on all important resources.

EIS Contact:

Comments on this EIS should be directed to:

Arlan Hiner
Rock Springs District Office
Bureau of Land Management
280 Highway 191 North
Rock Springs, WY 82901

For further information, contact Arlan Hiner at the BLM Rock Springs District Office (phone [307] 352-0206).

Date draft EIS made available to Environmental Protection Agency and the public: July 25, 1997

Date comments on the draft EIS must be received to be considered in the final EIS: September 8, 1997

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003-1828

In Reply Refer To:

1793 (930)
Jonah II DEIS

JUL 16 1997

Dear Reviewer:

The Draft Environmental Impact Statement (DEIS) on the proposed Jonah Field II Natural Gas Project is submitted for your review and comment. This DEIS has been prepared to analyze the potential impacts from natural gas development proposed by McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, and Western Gas Resources, Inc., (Operators) within the Jonah Field located in Sublette County, Wyoming. This is a new natural gas field with only 49 existing or analyzed wells in the field.

The Operators propose to drill up to 450 exploratory, delineation, or development wells over the next 15 years to recover natural gas from existing Federal and State oil and gas leases. Additional roads and pipelines would be necessary to link the wells with existing transportation pipelines.

If you wish to comment on the DEIS, we request that you make your comments as specific as possible. Comments will be more helpful if they include suggested changes, sources, or methodologies. Opinions or preferences will not receive a formal response. However, they will be considered and included as part of the BLM decision making process.

A public meeting will be held on Monday August 18, 1997, in Pinedale, Wyoming, at the Pinedale Library, 40 South Fremont Street, at 7 p.m. The purpose of this meeting is to describe the project, receive verbal comments, and to answer any questions you may have regarding the project. In order to make sure everyone has a chance to speak, comments should be limited to 10 minutes. Also, an open house will be held that afternoon at the Pinedale Library from 1:30 - 4:00 p.m. The purpose of this open house is to answer any questions you may have about the project.

This DEIS was prepared pursuant to the National Environmental Policy Act and other regulations and statutes to address possible environmental and socio-economic impacts which could result from the project. The DEIS is not a decision document. Its purpose

is to inform the public of the anticipated impacts associated with implementing the companies' drilling proposal and to evaluate alternatives to the proposal.

Please retain this document for future reference. A copy of the DEIS has been sent to affected Government agencies and to those persons who responded to scoping or otherwise indicated to BLM they wished to receive the document. Copies of the DEIS are available for public inspection at the following locations:

Bureau of Land Management Wyoming State Office 5353 Yellowstone Road Cheyenne, WY 82001	Bureau of Land Management Rock Springs District Office 280 Highway 191 North Rock Springs, WY 82901	Bureau of Land Management Pinedale Resource Area Office 432 E. Mill Street Pinedale, WY 82941

Comments, including names and street addresses of respondents, will be available for public review at the addresses listed above during regular business hours (7:45 a.m. - 4:30 p.m.), Monday through Friday, except holidays, and may be published as part of the DEIS. Individual respondents may request confidentiality. If you wish to withhold your name or street address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your written comment. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Sincerely,

Alan L Kesterke

Alan L. Kesterke
Associate State Director

EXECUTIVE SUMMARY

McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, Western Gas Resources Company, and other natural gas operators (collectively known as the Operators) propose to explore for and develop natural gas reserves on the Jonah II Project Area (J2PA) in southcentral Sublette County, Wyoming in portions of Townships 28 and 29 North, Ranges 107 through 109 West. The U.S. Department of the Interior, Bureau of Land Management (BLM) (Pinedale and Green River Resource Areas, Rock Springs District) has determined that the Operators' proposed project would constitute a major federal action and therefore requires the preparation of an Environmental Impact Statement (EIS) in accordance with the National Environmental Policy Act of 1969 as amended (NEPA). This Draft EIS was prepared in accordance with NEPA to assess the environmental consequences of the Operator's proposed development (i.e., the Proposed Action), and is intended to provide the public and decision makers with a complete and objective evaluation of impacts, both beneficial and adverse, resulting from the Proposed Action and reasonable alternatives.

The Proposed Action, two alternative development strategies (i.e., a sensitive resource protection alternative [Alternative A] and a maximum density of 4 well locations per section alternative [Alternative B]), and a No Action Alternative are analyzed. Additional alternatives including those considering higher and lower well densities and an alternative requiring the use of directional drilling were considered but rejected for environmental, economic, and/or legal reasons.

The No Action Alternative analyzed in this EIS would involve the rejection of the Operator's Proposed Action and Alternatives A and B. This alternative serves as a benchmark, enabling decision makers and the public to compare the magnitude of environmental of the development alternatives.

Public scoping was conducted with scoping statements mailed to potentially interested parties and the media in July 1996 and January 1997, and public meetings were held in July and November 1996. All issues identified during scoping and by a Bureau of Land Management Interdisciplinary Team review were considered during the preparation of this document. The proposed project is in conformance with the BLM Pinedale and Green River Resource Area Resource Management Plans, the Sublette County Land Use Plan, and the State of Wyoming Land Use Plan.

The proposed project is to explore for and develop natural gas and condensate reserves present in the Lance Formation and other formations at depths of approximately 11,000 ft in the J2PA. The J2PA encompasses approximately 59,600 acres (56,400 acres federal surface/federal mineral, 2,560 state surface/state mineral, and 640 acres private surface/federal mineral). The BLM has determined that J2PA lands are available for leasing and development for natural gas resources and previous development for these resources has occurred on the area as authorized by the *McMurry Oil Company Jonah Prospect Field Natural Gas Development Environmental Assessment* (EA). Approximately 49 well locations and associated access roads and pipelines currently exist or have been authorized for the J2PA. Maintenance of existing wells will continue as authorized by existing permits and the aforementioned EA during the preparation of this EIS.

Operators propose to construct, drill, complete, operate, and reclaim 450 well locations (1,125 acres - 2.5 acres/location) on variable spacing patterns within the J2PA beginning in 1997 and continuing for an estimated Life of Project (LOP) of 40-50 years. Additional construction activities include a total of approximately 180 mi of new roads with adjacent pipelines (1,527 acres - 0.4 mi/location), 17 mi of improvements to the Burma and Luman Roads (121 acres), 4 compressor stations (16 acres - 4 acres/station), 10 water wells (5 acres - 0.5 acres/well), and 22 mi of sales pipeline outside the J2PA (133 acres - 6 acres/mi). Standard procedures as currently used in gas field developments throughout Wyoming would be employed during project development and operations, and all project activities conducted during the LOP would comply with applicable federal, state, and county laws, regulations, and stipulations. Gas from the project would be transported through existing and newly developed pipelines linking the J2PA with existing regional pipelines north and south of the project area.

Total initial ground surface disturbance required for the proposed project would range from a maximum of

2,927 acres for the Proposed Action to 2,750 acres for Alternative A, to 2,262 acres for Alternative B. LOP disturbance under the Proposed Action, Alternative A, and Alternative B would be approximately 1,086 acres, 1,030 acres, and 876 acres, respectively. Existing surface disturbance of 152 acres is included in the LOP totals since these areas would be required for the project.

It is anticipated that field development would require 10-15 years, with approximately 30 wells being drilled per year. The proposed drilling schedule would require an estimated maximum of 4 drill rigs during peak drilling operations. Each drill rig would be operated on a 24-hour basis and require 3 crews of 7 people. As many as 30 people may be at a well location for short periods to conduct specific tasks such as fracturing. It would take approximately 49 days and to construct, drill, complete, and tie in each well location. Approximately 2,039 work-years would be required for the project.

Access roads would be constructed, upgraded, and maintained in accordance with the transportation planning process described in the Transportation Plan for this project (see Appendix A), and it is anticipated that the maximum number of project-required round-trips to and from the field during project development would be 150 per day. The estimated maximum number of round-trips during project operations (production) is 10 trips per day.

Critical elements of the human environment that could be affected by the proposed project include air quality, cultural remains, floodplains, Native American religious concerns, threatened and endangered (T&E) species, hazardous or solid wastes (see Appendix C), water quality, wetlands/ riparian zones, and wilderness. The only potentially significant project-specific adverse impact to these elements could occur to air quality under implementation of any developement alternative (i.e., visibility impacts may exceed U.S. Forest Service [USFS] "Limit of Acceptable Change" within the PSD Class I Bridger Wilderness Area).

The J2PA has a continental, semi-arid, cold desert climate and is located in the central Green River Basin. The topography is relatively flat, rolling, or somewhat dissected, and elevations range from 6,940 to 7,342 ft. Ephemeral drainages flow to the Green River in all directions but the northeast. Groundwater and surface water are variable in quality, and the major use is for livestock. No significant impacts to water resources on the J2PA are anticipated.

Air quality impacts from the proposed project are not anticipated to be significant under any of the proposed development scenarios, since no violations of applicable federal or state air quality regulations would occur. However, significant cumulative impacts (i.e., impacts resulting from the incremental effects of an action added to other past, present, and reasonably foreseeable future actions) may occur in the nearby Bridger Wilderness Area located approximately 20 mi northeast of the J2PA. Significant impacts could occur to the air quality related value of visibility in the wilderness area; it is estimated that project operations could result in a perceptible visibility impact on a maximum of 11 days annually.

Twenty-two soil map units occur in the J2PA and most have construction and reclamation limitations; however, no significant impacts to soils are anticipated under any of the proposed development alternatives. Several known sand dunes and other windblown deposits occur in the area. Plant cover values in the area are variable on the three dominant vegetation types--Wyoming big sagebrush/grassland, saltbush, and cushion plant communities. Approximately 4,986 animal unit months are provided in the six grazing allotments on the area. Wetlands in the area are limited, are restricted to drainage bottoms and around impoundments, and would be avoided during project development, where practical. A Reclamation Plan for the project has been prepared (see Appendix B), and adherence to reclamation protocol specified in the plan would minimize potential adverse effects to soils, vegetation, and related land uses.

While no fossil localities of importance are known to occur within the J2PA, many are known from the vicinity, and it is likely that significant fossils are present in the area. Site-specific paleontologic surveys and monitoring would be conducted as necessary to minimize potential adverse impacts to significant fossils.

There are currently no mineral development actions proposed for the J2PA other than oil and gas development, nor are other mineral developments anticipated due to lack of availability. Exploration for other minerals may occur on existing J2PA leases or

claims, and potential development of other mineral resources on the J2PA would be delayed until after the LOP. The development of oil and gas reserves from the J2PA as proposed by the Operators is consistent with local and regional land use planning decisions for the area; however, the oil and gas reserves extracted from the area would be unavailable for future generations. In addition, if the project is implemented under either Alternatives A or B and oil and natural gas reserves are not fully recovered, significant adverse impacts to mineral resources could occur. Further, the denial of exploration and development activities under the No Action Alternative would constitute a significant impact since it would be in violation of contractual agreements between the U.S. and lessees.

During the LOP and beyond, the J2PA would be remain suitable for the historic land uses of livestock grazing, wildlife use, and recreation; however, the predominant use of the area would change to oil and gas development for the LOP. While no significant impacts to land use are anticipated, some recreational users of the J2PA may be displaced to nearby undisturbed areas due to the presence of oil and gas developments.

Pronghorn antelope is the primary big game species present on the project area, and hunting for this species as well as for sage grouse would continue during the LOP. No crucial habitat for pronghorn occurs on the area; however, the area is used by pronghorn for migration between summer and winter ranges. Sage grouse leks and raptor nests occur in and adjacent to the area, and monitoring would be conducted annually to determine the activity status of leks and nests proximal to proposed development sites as specified in the Wildlife Monitoring/Protection Plan (see Appendix D). Additional protection of sage grouse leks and raptor nests would be provided under implementation of Alternative A, since a 0.5 mi disturbance buffer would be provided around these locations.

T&E species that may occur on the area include black-footed ferret, bald eagle, peregrine falcon, and whooping crane as described in the Biological Assessment (see Appendix E). In addition, mountain plover, a candidate species for T&E listing, potentially occurs on the area, and 4 T&E fish species--Colorado squawfish, humpback chub, bonytail chub, and razorback sucker--occur downstream in the Green River/Colorado River drainage. No adverse impacts to these species are anticipated from project development.

Potential adverse impacts to cultural resources would be mitigated through data recovery and/or avoidance of significant properties. Site-specific surveys for cultural resources would be conducted prior to disturbance, and formal Wyoming State Historic Preservation Office consultation would occur where cultural resource properties may be impacted. If eligible cultural properties are found within the J2PA and they cannot be avoided, a data recovery program would be implemented.

No sites of Native American religious or cultural importance are known to occur on the J2PA, and continued consultations with potentially affected Native American Tribes would occur to ensure all such sites are identified. If sites or localities of religious and/or cultural importance are identified, coordinated efforts would be made to ensure adequate site protection.

Communities most likely to be affected by the proposed project are Pinedale, Big Piney, Marbleton, and Boulder in Sublette County; La Barge in Lincoln County; and Eden/Farson and Rock Springs in Sweetwater County. Socioeconomic impacts to these cities and counties are anticipated to be beneficial with total increased salaries estimated at $6.5-$10 million per year during the 10-15 years of project development, and total government revenues estimated at $1,035.2 million for the first 10 years of the project under the Proposed Action. Under Alternatives A and B, revenues, royalties, taxes, salary payments, and associated income effects are anticipated to be reduced by approximately 6.7% and 27.3%, respectively. Under the No Action Alternative the economic benefits of the action alternatives would not be realized, and significant adverse impacts could occur by foregoing revenue generation.

Most development activities on the J2PA would not be visible from any major travel routes and adverse impacts would be mitigated by locating and painting aboveground facilities to blend with the natural landscape. The character of the landscape within the J2PA would not be altered significantly from that identified as appropriate for the area in BLM Resource Management Plans; however, the landscape character would change for the LOP and until

reclamation is successful from relatively undeveloped to an active oil and gas field.

Numerous standard, project-specific, and site-specific mitigation measures would be employed during all phases of the project to assure that potential impacts are minimized. Site-specific measures would be applied as specified in approved Applications for Permit to Drill and Rights-of-way applications for each new project feature. Surveys and/or monitoring would be conducted for cultural resources, paleontological resources, raptor nests, sage grouse leks, T&E species, and reclamation areas to document their status relative to specific disturbance activities. Reclamation would be conducted as soon as possible on areas disturbed during initial construction that are not required for the LOP. Upon completion of the project, all wells would be plugged and abandoned, surface facilities would be removed, and most disturbed areas would be reclaimed and revegetated.

This EIS presents the BLM's analysis of environmental impacts under authority of the NEPA and associated rules and guidelines. The BLM will use this analysis to make a decision regarding the continued authorization of construction, drilling, completion, operation, and reclamation activities as proposed by the Operators for exploration and development of natural gas on the J2PA. The decision to allow some development of J2PA lands was made in the Pinedale Resource Area Resource Management Plan, where it was determined that J2PA lands were available for leasing.

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1.0 INTRODUCTION

McMurry Oil Company (MOC), Snyder Oil Corporation (SOCO), Amoco Production Company (Amoco), and Western Gas Resources (WGR) (hereafter referred to as the Operators) have notified the U.S. Department of the Interior (USDI), Bureau of Land Management (BLM) that they intend to expand natural gas exploration and development from the existing Jonah Prospect Field north into an adjacent area. The Jonah Field II Project Area (J2PA) inclusive of northern portions of the Jonah Prospect Field is located on lands administered by the BLM's Green River and Pinedale Resource Areas (GRRA and PRA), Rock Springs District, in Sublette County approximately 32 mi southeast of Pinedale, 28 mi northwest of Farson, and 2 to 17 mi west of U.S. Highway 191 (Figure 1.1). The project area includes portions of Townships 28 and 29 North, Ranges 107, 108, and 109 West, and encompasses approximately 59,600 acres, all of which is federal surface/federal minerals except for 2,560 acres (4%) of state surface/state minerals and 640 acres (1%) of private surface/federal minerals.

Based on the Operators' current knowledge of natural gas reservoir characteristics (geology, flow from existing wells, expected recovery rates, and economics), the Operators anticipate field development in the J2PA to involve drilling and developing 150-450 well locations, depending on the outcome of continued exploration and reservoir characterization. Operators anticipate that the most likely number of well locations would be 300. Well spacing would not exceed eight well locations per section (1 well location/80 acres). The construction of various facilities (roads, pipelines, water wells, disposal wells, compressor stations, etc.) would occur in association with the development of well locations. Because the Operators have identified the potential for 450 well locations and associated facilities in the J2PA, the BLM determined it prudent to analyze impacts associated with this level of development.

Standard operating procedures and practices currently used in gas field development throughout Wyoming and the surrounding region would be employed during this project. Construction, development, operations, and abandonment would comply with applicable federal, state, and county laws, rules, and regulations. Numerous standard, project-specific, and site-specific mitigation measures would be employed during all phases of the project to minimize potential impacts to the environment.

1.1 PURPOSE AND NEED

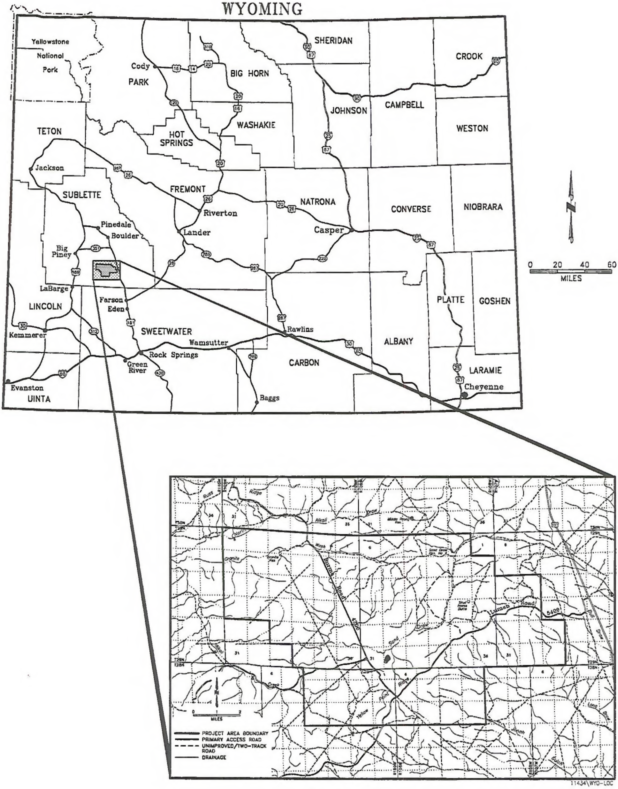
The purpose of the proposed project is to enable the commercial production of federally owned natural gas by private companies, pursuant to their rights under existing oil and gas leases issued by the BLM. National mineral leasing policies and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands as long as unnecessary and undue environmental degradation is not incurred.

Revenues from the first 10 years of project development are estimated to be approximately 1.035 billion dollars, of which approximately 12.5% ($129 million) would be for federal royalty payments (see Section 4.4). Half of the royalty payment would be returned to the State of Wyoming.

Natural gas is an integral part of the U.S. energy future due to its availability and the presence of an existing market delivery infrastructure. By developing domestic reserves of clean burning natural gas, the U.S. would reduce dependence on foreign sources of energy and maintain an adequate and stable supply of fuel to maintain economic well-being, industrial production, and national security. The use of natural gas in chemical and energy production applications would result in lower air pollutant emissions than the comparable use of other fossil fuels (e.g., coal, diesel, or petroleum products). The environmental advantages of burning natural gas are emphasized in the Clean Air Act Amendments of 1990.

1.2 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

This environmental impact statement (EIS) is prepared in accordance with the *National Environmental Policy Act of 1969*, as amended (NEPA) and is in compliance with all applicable regulations and laws passed subsequently, including Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508), USDI requirements (*Department Manual 516, Environmental Quality* [USDI 1980]), guidelines listed



Map 1.1 General Location of the Jonah Field II Project Area, Sublette County, Wyoming, 1997.

in the BLM *Manual Handbook, H-1790-1* (BLM 1988a), and *Guidelines for Assessing and Documenting Cumulative Impacts* (BLM 1994a). This EIS assesses the environmental impacts of the Proposed Action, reasonable alternatives, and the No Action Alternative, and will serve to guide the decision-making process. Policies for development and land use decisions within this area are contained in the draft and final PRA Resource Management Plan (RMP)/EIS (BLM 1987a, 1987b) and the Record of Decision (ROD) (BLM 1988b), the draft and final GRRA RMP/EIS (BLM 1992a, 1996a), and the *McMurry Oil Company Jonah Prospect Field Natural Gas Development Environmental Assessment* (BLM 1994b).

The proposed project is in accordance with the PRA RMP (BLM 1987a, 1987b, 1988b) and the GRRA RMP (BLM 1992a, 1996a), and no amendments to these RMPs would be necessary to approve the proposed project. The PRA RMP states that "the public lands and federal mineral estate will be made available for orderly and efficient development of mineral resources. All minerals actions will comply with goals, objectives, and resource restrictions (mitigations) required to protect the other resource values in the planning area." The GRRA RMP states that "the objective for management of the minerals program is to maintain or enhance opportunities for mineral exploration and development, while protecting other resource values. The objectives for oil and gas resources would be to provide for leasing, exploration, and development of oil and gas, while protecting other values." Reasonably Foreseeable Development (RFD), as described in the PRA RMP (BLM 1987a) estimates that 45 wells per year (i.e., the 7-year average between 1978 and 1985) would disturb 742 acres per year, with 247 acres being disturbed for the life of the wells. Twenty-nine wells would be completed as producers. Further, the PRA RMP indicates that the J2PA is known to contain hydrocarbons and has a very high potential for oil and gas development. RFD as described in the GRRA RMP (BLM 1996a) predicts an RFD of 1,300 well completions by 2010 (i.e., 65 wells per year); each well would result in 13.5 acres of disturbance, for a total of 17,550 acres of disturbance. The GRRA RMP indicates that the J2PA has a moderate to high potential for oil and gas development.

The proposed project is also in conformance with the *State of Wyoming Land Use Plan* (Wyoming State Land Use Commission 1979) and the Sublette County Land Use Plan (Sublette County Board of Commissioners [SCBC] 1978).

A tiered approach to environmental review is used by the BLM in the leasing, exploration, and development of mineral resources. Initial environmental review occurs during BLM land use planning, during which the appropriateness of leasing and stipulations for development are identified with public input. Accordingly, the federal minerals within the J2PA that have been leased to the Operators carry a contractual commitment to allow for their development in accordance with the terms and conditions of the lease. During exploration, site-specific environmental assessments (EAs) are prepared to ensure that significant impacts to surface and subsurface resource values do not occur. The Operators' exploration resulted in the discovery of economically recoverable quantities of natural gas; therefore, this EIS will assess the direct, indirect, and cumulative impacts to the human and natural environment that may result from the recovery of natural gas on the J2PA. Once approval is given for the development of the J2PA, site-specific EAs would be prepared for each *Application for Permit to Drill* (APD) and each right-of-way (ROW) application for access roads, pipelines, etc., as these applications are submitted.

While the BLM has the authority to deny individual APDs and ROW applications, the lessees' right to drill and develop somewhere within the leasehold cannot be denied. Pursuant to the Federal Land Policy and Management Act of 1976 (FLPMA), the BLM also has the authority and responsibility to protect the environment within federal and oil gas leases; therefore, restrictions are imposed on lease terms. However, mitigation measures that would render a proposed operation uneconomic or unfeasible are not consistent with the lessee's rights and cannot be required unless they are included as a lease stipulation or are necessary to prevent unnecessary and undue degradation of public lands or resources (BLM Instruction Memorandum 92-67).

All mineral actions would comply with established goals, objectives, and resource restrictions (mitigations) required to protect natural resource values in the planning area. Resources, impacts, and associated mitigation and monitoring measures on federal, state, and private lands within the J2PA will be addressed in the EIS.

1.3 AUTHORIZING ACTIONS

1.3.1 Existing Oil and Gas Leases

The development of federal oil and gas leases and associated facilities is an integral part of the BLM's oil and gas leasing program. The Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases; therefore, restrictions can be imposed on the lease terms (see *Cooper Valley Machinery Works, Inc. vs. Andrus*, 474 F. Supp. 189, 191; D.D.C. 1973; 653 F. 2nd 595; D.D.C. 1981; *Natural Resources Defense Council vs. Berland*, 458 F. Supp. 925, 937; D.D.C. 1978), but the Secretary cannot deny development of the lease. Denial of the current development proposal would not, therefore, be a denial of all natural gas development in the area.

The Tenth Circuit Court of Appeals in *Sierra Club vs. Peterson* (717 F. 2nd 1409, 1983) found that, *"on land leased without a No Surface Occupancy stipulation, the Department cannot deny the permit to drill...once the land is leased the Department no longer has the authority to preclude surface disturbing activity even if the environmental impact of such activity is significant. The Department can only impose mitigation measures upon a lessee who pursues surface disturbing exploration and/or drilling activities"*. The court goes on to say, *"...notwithstanding the assurance that a later site-specific environmental analysis will be made, in issuing these leases the Department has made an irrevocable commitment to allow some surface disturbing activities, including drilling and road building"*.

This has been clarified somewhat in Instruction Memorandum 92-67 issued by the Director, BLM on December 3, 1992, which states that, *"Because all oil and gas activities are subject to FLPMA, mitigation required to protect public lands from unnecessary and undue degradation is consistent with the lease rights granted. The caveat, however, is that...unnecessary and undue degradation implies that there is also necessary and due degradation"*. As a matter of policy, any mitigation measure *"which would render a proposed operation uneconomic or technically unfeasible is not considered to be consistent with a lessee's rights and cannot be required absent a lease stipulation, unless it is determined that such mitigation is required to prevent unnecessary and undue degradation of public lands or resources..."*.

To deny all activity could constitute a "taking" of the Operator's right to conduct exploration activities on the subject federal leases, and the court held in *Union Oil Company of California vs. Morton*, *"Congress itself can order leases forfeited, subject to payment of compensations. But without Congressional authorization, the Secretary of the executive branch in general has no intrinsic power of condemnation"*. At this time, Congress has given no indication to the BLM that it is considering action on this matter and the prospect of securing passage of such legislation and appropriation of funds for that specific purpose is extremely remote.

Most leases in the J2PA contain various stipulations addressing surface disturbance, steep slopes, wildlife, and other matters of concern. These stipulations would allow the BLM to preclude development in certain areas (e.g., where slopes exceed 25%) or at certain times of the year (e.g., to protect raptor nests) if operations cannot be acceptably mitigated. However, there is no stipulation, such as a No Surface Occupancy (NSO), that would allow the BLM to preclude drilling operations everywhere on a lease at all times of the year. If any one of the stipulations cannot be acceptably implemented and impacts mitigated, then an exception would not be granted. A decision, therefore, of no action, as authorized by the leases, would only be considered, given one of the following conditions.

- If there were no acceptable means of mitigating significant adverse impacts to stipulated surface resource values, then this would trigger denial of the APD and require consideration and analysis of another alternative(s). Effectively, exception(s) to one or more of the lease stipulations would not be approved.
- If the USFWS concluded that the Proposed Action and alternatives would likely jeopardize the continued existence of threatened plant and/or animal species, then the APD and lease development may be denied in whole or in part.

This EIS will help to determine whether the proposed project meets any of these conditions.

1.3.2 Oil and Gas Development

BLM regulations governing operations associated with the exploration, development, and production of oil and gas deposits from leases issued or approved by

the U.S. are contained in 43 CFR 3160. Further, drilling of federal minerals is subject to the BLM's Onshore Oil and Gas Orders (43 CFR 3164). The Operators' drilling program would be conducted under Onshore Oil and Gas Order No. 2 and would require BLM approval of each well location and associated access road prior to drilling/construction through the APD process. BLM Onshore Orders Nos. 1 and 2 require the applicant to comply with the following conditions:

- operations must result in the diligent development and efficient recovery of resources;
- all activities must comply with applicable federal, state, and local laws and regulations applicable to federal leases;
- all activities must contain adequate safeguards to protect the environment;
- disturbed lands must be properly reclaimed;
- underground sources of fresh and usable water must be protected from fluid injection operations; and
- all activities must protect public health and safety.

Onshore Order No. 1 also specifically states that "lessees and operators shall be held fully accountable for their contractor's compliance with the requirements of the approved permit and/or plan."

ROWs and Temporary Use Permits on BLM-managed lands would be issued under the authority of the *Mineral Leasing Act of 1920* or Title V of FLPMA. The proposed project would comply with all relevant federal, state, and local laws (Table 1.1).

1.4 PUBLIC PARTICIPATION AND ISSUES AND CONCERNS

To encourage early and improved public participation and agency cooperation, a number of meetings involving the BLM, Operators, various agencies, and the public have been held. On July 12, 1996, a scoping notice describing the project and requesting comments was mailed to 156 government offices, elected officials, public land users and groups, newspapers, and radio and TV stations. An organized tour of the project area for all interested persons was conducted on July 29, 1996, and a public meeting was held on that same date in Pinedale. Additional opportunities for agency and public participation are planned during the preparation of this EIS. The following issues and concerns were identified during public scoping, consultation, and coordination with government agencies (e.g., Wyoming Game and Fish Department [WGFD], U.S. Fish and Wildlife Service [USFWS], U.S. Forest Service [USFS], Environmental Protection Agency [EPA]), and internal scoping by the BLM. Additional concerns may be identified during EIS preparation, and these concerns will be added to the list of issues and concerns that have been identified to date, and analyzed as appropriate. Issues and concerns that have been identified include the following.

NEPA Compliance

- Analysis of positive cumulative impacts from natural gas use, as opposed to other fuels (e.g., coal, fuel oil, gasoline), regarding regional air pollutant emissions (see Section 4.1.1.6)
- Analysis of cumulative impacts in conjunction with other existing and proposed developments, avoiding a "piecemeal" approach (see Chapter 4.0)
- Detailed analysis of alternatives (see Chapter 4.0)
- Analysis of a "true" No Action Alternative (see Section 2.5 and Chapter 4.0)
- BLM preparation of a programmatic EIS for southwest Wyoming (beyond the scope of this EIS)
- Analysis of an alternative which would minimize surface impacts (see Sections 2.2 and 2.3 and Chapter 4.0)
- Inclusion of existing wells in analysis (see Table 2.1 and Chapter 4.0)
- Cumulative analysis based on more than just actual acreage of surface disturbance (see Chapter 4.0)
- Concerns with the leasing process (beyond the scope of this EIS)
- Desire to streamline the NEPA process to reduce approval time and cost (Green River Basin Advisory Committee [GRBAC] streamlining recommendations were incorporated during the preparation of this EIS.)
- Cooperation and consultation with coordinating agencies early in the NEPA process to provide additional expertise (see Section 1.4)
- Timely development of resources and avoidance of unnecessary delays (see

Table 1.1 Major Federal, State, and Local Permits, Approvals, and Authorizing Actions for the Jonah Field II Natural Gas Project, Sublette County, Wyoming, 1997.[1]

Agency	Permit, Approval, or Action	Authority
Bureau of Land Management (BLM)	Permit to drill, deepen, or plug back on BLM-managed land (APD process).	Mineral Leasing Act of 1920 (30 United States Code [U.S.C.] 181 et seq.); 43 CFR 3162.
	Rights-of-way grants and temporary use permits for pipelines and central tank battery on BLM-managed land.	Mineral Leasing Act of 1920, as amended (30 U.S.C. 185); 43 CFR 3180.
	Right-of-way grants for access roads on BLM-managed land.	FLPMA (43 U.S.C. 1761 - 1771); 43 CFR 2800.
	Authorization for flaring and venting of natural gas on BLM-managed land.	Mineral Leasing Act of 1920 (30 U.S.C. 181 et seq.); 43 CFR 3162.
	Plugging and abandonment of a well on BLM-managed land.	Mineral Leasing Act of 1920 (30 U.S.C. 181 et seq.); 43 CFR 3162.
	Antiquities and cultural resource permits on BLM-managed land.	Antiquities Act of 1906 (16 U.S.C. Section 431-433); Archaeological Resources Public Protection Act of 1979 (16 U.S.C. Sections 470aa - 47011); 43 CFR 3.
	Approval to dispose of produced water on BLM-managed land.	Mineral Leasing Act of 1920 (30 U.S.C. 181 et seq.); 43 CFR 3164; Onshore Oil and Gas Order No. 7.
U.S. Army Corps of Engineers (COE)	Section 404 permits, and coordination regarding placement of dredged or fill material in area waters and adjacent wetlands.	Section 404 of the Clean Water Act of 1972 (40 CFR 122 - 123, 230).
U.S. Fish and Wildlife Service (USFWS)	Coordination, consultation, and impact review on federally listed threatened and endangered (T&E) species.	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.).; Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. et seq.); Bald and Golden Eagle Act (16 U.S.C. 668-668c).
U.S. Environmental Protection Agency (EPA)	Spill Prevention Control and Countermeasure Plans (SPCCPs).	40 CFR 112.
	Regulation of hazardous waste treatment, storage, and/or disposal.	Resource Conservation and Recovery Act (42 U.S.C. Section 6901).
U.S. Department of Energy	Regulation of interstate pipeline product transportation.	U.S. Codes
U.S. Department of Transportation	Control of pipeline maintenance and operation.	49 CFR 191 and 192.
Wyoming Board of Land Commissioners/Land and Farm Loan Office	Approval of oil and gas leases, ROWs for long-term or permanent off-lease/off-unit roads and pipelines, temporary use permits, and developments on state lands.	Wyoming Statute (W.S.) 37-1-101 et seq.
Wyoming Department of Environmental Quality - Water Quality Division (WDEQ-WQD)	Permits to construct settling ponds and waste water systems, including ground water injection and disposal wells.	Wyoming Environmental Quality Act (W.S. 35-11-301 through 35-11-311).
	Regulation of the disposal of drilling fluids from abandoned reserve pits.	Wyoming Environmental Quality Act (W.S. 35-11-301 through 35-11-311).
	National Pollutant Discharge Elimination System (NPDES) permits for discharging waste water and storm water runoff.	WDEQ Rules and Regulations, Chapter 18. Wyoming Environmental Quality Act (W.S. 35-11-301 through 35-11-311); Section 405 of the Clean Water Act (40 CFR 122-124).
	Administrative approval for discharge of hydrostatic test water.	Wyoming Environmental Quality Act (W.S. 35-11-301 through 35-11-311).

Table 1.1 (Continued)

Agency	Permit, Approval, or Action	Authority
Wyoming Department of Environmental Quality - Air Quality Division (WDEQ-AQD)	Permits to construct and permits to operate.	Clean Air Act; Wyoming Environmental Quality Act (W.S. 35-11-201 through 35-11-212).
Wyoming Department of Environmental Quality - Land Quality Division (WDEQ-LQD)	Mine permits, impoundments, and drill hole plugging on state lands.	Wyoming Environmental Quality Act (W.S. 35-11-401 through 35-11-437).
Wyoming Department of Environmental Quality - Solid Waste Division	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations.	Wyoming Environmental Quality Act (W.S. 35-11-501 through 35-11-520).
Wyoming Department of Transportation (WDOT)	Permits for oversize, overlength, and overweight loads.	Chapters 17 and 20 of the Wyoming Highway Department Rules and Regulations.
Wyoming Oil and Gas Conservation Commission (WOGCC)	Permit to drill, deepen, or plug back (APD process).	WOGCC Regulations (Section III; Rule 305).
	Permit to use earthen pit (reserve pits).	WOGCC Regulations (Section III; Rule 326).
	Authorization for flaring or venting of gas.	WOGCC Regulations (Section III; Rule 346).
	Permit for Class II underground injection wells.	40 CFR 146; 40 CFR 147.2551.
	Well plugging and abandonment.	WOGCC Regulations (Section III; Rule 315).
	Change in depletion plans.	Wyoming Oil and Gas Act (W.S. 30-5-110).
Wyoming State Engineer's Office (WSEO)	Permits to appropriate groundwater (use, storage, wells, dewatering).	W.S. 41-121 through 147 (Form U.W.5)
Wyoming State Historic Preservation Office (SHPO)	Cultural resource protection, programmatic agreements, consultation.	Section 106 of National Historic Preservation Act and Advisory Council Regulations (36 CFR 800).
Sublette County	Construction/use permits.	Planning and Zoning Department.
	Conditional use permits.	Planning and Zoning Department.
	County road crossing/access permits.	Planning and Zoning Department.
	Small wastewater permits.	Planning and Zoning Department.
	Hazardous material recordation and storage.	Emergency Management Coordinator.
	Zone changes.	Planning and Zoning Department.
	Noxious weed control.	Weed and Pest Department.

[1] This list is intended to provide an overview of the key regulatory requirements that would govern project implementation. Additional approvals, permits, and authorizing actions may be necessary.

Chapter 2.0)
- Incorporation of Interior Board of Land Appeals decisions into the analysis (see Chapter 4.0)
- Provision of detailed information in the EIS on oil and gas leases held by the Operators (beyond the scope of this EIS)
- Provision, in the EIS, of a detailed resource protection alternative designed to reduce, to the greatest extent possible, the environmental impacts of the project (see Section 2.2 and Chapter 4.0)
- Definition of appropriate mitigation measures for all resources (see Section 2.4.11 and Chapter 4.0)

Development Activities
- Definition of "optimal recovery" within the project area (see Section 2.1)
- Use of best management practices during development and operations (see Section 2.4)
- Minimization of surface disturbance to reduce impacts of pipelines and other facilities (see Section 2.4.11 and Chapter 4.0)
- Field operations (see Section 2.4)
- Staged development (i.e., development in phases) (see Section 2.6)
- Reserve pit practices (see Sections 2.4.3, 2.4.4, and 2.4.5)
- Produced water management (see Section 2.4.5)
- Waste management plans (see Section 2.4)
- Well operation practices (see Section 2.4.5)
- Inclusion of leak detection systems (see Section 2.4)
- Procurement of appropriate permits (see Section 1.3)
- Benefits of utilization of a new source of natural gas (see Section 4.4)
- Consideration of directional drilling as a method of minimizing environmental impacts (see Section 2.7)
- Avoidance of unreasonable restrictions on construction of utility and pipeline facilities (see Section 4.5.1)

Wildlife and Fisheries
- Analysis of direct, indirect, and cumulative impacts to wildlife habitat and the effects of wildlife displacement and habitat fragmentation (see Section 4.2.2)
- Definition and inclusion of effective mitigation and implementation procedures for habitat loss and decreased habitat effectiveness (see Section 2.4.11)
- Displacement of big game species (see Section 4.2.2)
- Potential impacts to the Sublette antelope herd migration and spring, summer, fall, and winter/transitional ranges (see Section 4.2.2)
- Impacts of roads and fences on big game, especially pronghorn antelope (see Section 4.2.2)
- Mortality to big game due to poaching and vehicle collisions (see Section 4.2.2)
- Impacts to sensitive, state priority, special status, and threatened and endangered (T&E) plant and animal species and their habitats, including downstream fisheries (see Section 4.2.3)
- Inclusion of USFWS's Endangered Species Act (ESA) Section 7 comments in the EIS for public review (see Appendix E, Biological Assessment)
- Water quality impacts, particularly on fisheries, migratory birds, and T&E species (see Sections 4.1.6, 4.2.2, and 4.2.3 and Appendix E)
- Avoidance of breeding areas of sensitive and USFWS candidate species during the breeding season (e.g., mountain plover) (see Sections 2.4.11.9 and 4.2.3.5 and Appendix E)
- Protection of burrowing owls, which are known to nest in the project area (see Sections 2.4.11.9 and 4.2.3)
- Acquisition and analysis of all available wildlife data (see Sections 3.3.2 and 4.2.2)
- Identification of sage grouse lek locations (see Section 3.3.2.4)
- Impacts of new power lines, especially on increased sage grouse predation (not applicable)
- Impacts of noise on sensitive wildlife, particularly strutting sage grouse (see Section 4.2.2)
- Potential impacts to sage grouse breeding, nesting, and wintering habitats (see Section 4.2.2)
- No construction within a 0.5-mi buffer of sage grouse leks (see Sections 2.2 and 4.2.2)
- No construction within a 2.0-mi buffer while sage grouse leks are active (see Section 2.4.11.9)

- Maintenance of a 0.75-mi buffer around active raptor nests during the breeding season (see Section 2.4.11.9)
- No surface occupancy within 1.0 mi of ferruginous hawk nests (see Section 2.4.11.9)
- Potential impacts to nesting raptors (see Section 4.2.2)
- Development of additional water sources for resident and migratory pronghorn antelope and for sage grouse (see Section 4.2.2.5)
- On- and off-site mitigation to ameliorate impacts to wildlife (see Section 4.2.2.5)
- Control of wildlife access to all pits and ponds (see Section 2.4.11.9)
- Expanded monitoring of wildlife resources (see Appendix D)
- Beneficial impacts to wildlife (see Section 4.2.2)

Vegetation

- Noxious weed control (see Appendix B)
- Potential impacts to and protection of wetlands and riparian areas (see Sections 2.4.11.6, 2.4.11.8, 4.1.6, and 4.2.1)
- Coordination with the U.S. Army Corps of Engineers (COE) regarding the need for 404 Permits (see Sections 2.4.11.6 and 4.1.6)

Surface Water and Groundwater

- Impacts to and protection of surface water and groundwater quality and quantity (see Section 4.1.6)
- Protection of aquatic habitats (see Sections 4.1.6 and 4.2.1)
- Groundwater contamination, monitoring, and protection plan (see Section 4.1.6)
- Depth to usable groundwater (see Section 3.2.7.2)
- Acidification of high mountain lakes (see Section 4.1.1)
- Use of produced water for wetland development (see Section 4.1.6.5)

Socioeconomics

- Impacts to the socioeconomics and infrastructures of local communities from an increased work force (see Section 4.4)
- Analysis of cumulative socioeconomic impacts to southwestern Wyoming (see Section 4.4)
- Provision of jobs, increased income, investments, federal and state royalties, and county *ad valorem* taxes (see Section 4.4)
- Emphasis on socioeconomic analysis and the provision of a more detailed breakdown of socioeconomic benefits, incorporating the University of Wyoming work on the Southwest Wyoming Resource Evaluation (Phases I and II) (see Section 4.4)
- Sustainability of beneficial socioeconomic impacts of the project, rather than a "boom and bust" cycle (see Section 4.4)
- Sustainability of beneficial socioeconomic impacts of the project by year-round development (see Section 4.4)
- Consideration of an employee retraining and buyout program to mitigate the short-term duration of the project, or of extending the lifetime of field to retain workers for a longer period of time (comment noted)
- Emphasize that 70% of people in Wyoming benefit from revenues generated from the oil/gas industry (see Section 4.4)
- Implementation of a hiring preference for local residents (see Section 2.4.11.12)
- Preservation of "rural" culture and emphasis on social impacts of the proposed project (see Section 4.4)
- Increased regional employment opportunities and use of local contractors (see Section 4.4)
- Increased use of available housing (see Section 4.4)
- Increased regional economic activity (see Section 4.4)

Land Use

- Maintenance of reasonable access to public lands (see Section 4.5)
- Balance of all relevant factors, including national energy policy and its multiple use mandate, in the decision-making process (comment noted)
- Decreased availability or use of state lands, resulting in lost revenue to the state (comment noted)
- Land use alterations (see Section 4.5)
- Potential conflicts with livestock and range improvements (see Section 4.5.2)
- Potential impacts to nearby Wilderness Areas (see Section 4.1.1)
- Continuation of the historic pattern of cooperation between landowners, mineral owners, and BLM (see Section 4.5)
- Split-estate concerns (see Section 4.5.1)

- Compatibility of development with existing land uses (see Section 4.5)

Livestock Grazing

- Disruption of livestock operations and loss of forage (see Section 4.5.2)
- Development of additional water sources for livestock (see Section 4.5.2.5)

Cultural Resources

- Potential impacts on cultural/historic resources, including historic trails, and adherence to National Historic Preservation Act of 1966 (NHPA) and Advisory Council on Historic Preservation regulations (see Section 4.3)
- Assurance that Class III cultural inventories should focus on high density site areas and significant sites (see Section 4.3.5)
- Use of cultural resources programmatic agreement to expedite the cultural clearance process (i.e., use of synthesis/context of development) (see Section 4.3.5)
- Recognition and protection of the existing rural cultural landscape of the project area (see Section 4.3.5)

Transportation

- Road development and transportation management and resultant impacts (see Appendix A)
- Improvements to Burma and Luman Roads for safety and visibility (see Appendix A)
- Provision of a clearly defined transportation system proposal and range of alternatives in the EIS (see Appendix A)
- Minimization of additional roads required in the project area, and adequate maintenance of those roads (see Appendix A)
- Increased drilling-related traffic on federal and state highways (see Appendix A)
- Increased public access to the project area (see Section 4.5)

Air Quality

- Air quality impacts and conformance with the Clean Air Act (see Section 4.1.1)
- Primacy of Wyoming Department of Environmental Quality (WDEQ) over air quality issues (comment noted)
- Reference to and incorporation of Amoco comments on the Moxa and Fontenelle EIS Air Quality Analysis (comment noted)
- Correction of deficiencies (identified by the EPA and USFS) in the Amoco comments on the Moxa and Fontenelle EIS Air Quality Analysis (see Section 4.1.1)
- Impacts to air quality, wilderness lakes, and visibility in the Wind River Mountains (see Section 4.1.1)
- Basin-wide cumulative impacts air quality analysis, and discussion and implementation of state-of-the-art pollution control technology (see Section 4.1.1)
- Airborne construction, operation, and equipment-related emissions and fugitive dust (see Section 4.1.1)
- Expanded monitoring of air quality (see Section 4.1.1.5)
- Human and domestic animal safety, especially regarding release of airborne pollutants (see Section 4.1.1)
- Acknowledgement that oil/gas development is not the major source of sulfur oxide (SO_x) and nitrogen oxide (NO_x) emissions, and that increased production and use of natural gas could lead to improved regional air quality (see Section 4.1.1)
- Discussion of condensate emissions, condensate recovery, and volatile organic compounds (VOCs), and how they will be handled (see Section 4.1.1)

Hazardous Materials

- Hazardous material use, production, transport, storage, and disposal (see Appendix C)
- Wastewater discharge, spills, and evaporation ponds (see Section 2.4.11.6)
- Waste management (see Section 2.4.11.17)

Geology/Soils

- Highly erodible and unstable soils and associated erosion (see Sections 3.2.6 and 4.1.5)
- Potential impacts on paleontological resources (see Sections 4.1.3)
- Analysis of cumulative impacts of the entire project area on highly sensitive soils prior to approval of the project (see Section 4.1.5.6)

Reclamation

- Suitable reclamation and reseeding of disturbed areas (see Appendix B)
- Use of native species during reclamation (see Appendix B)
- Successful reclamation of surface disturbance as quickly as possible (see Appendix B)
- Revegetation and reclamation of short-term disturbances and long-term stabilization (see Appendix B)

Recreation

- Loss of open spaces and recreational opportunities (see Section 4.5.3)
- Economic contributions from hunting and other recreation uses (see Section 4.5.3)

Visual Resources

- Visual resource sensitivity and reduced visual quality, including degradation of unroaded expanses of prairie and wild areas (see Section 4.6)

Other General Concerns

- Increased human activity in the project area (see Chapter 4.0)
- Implementation of less extensive development plans (comment noted)
- Coordination of EIS work with the existing working group for the Big Piney/LaBarge Coordinated Activity Plan area (comment noted)
- Use of state inventory sources (e.g., air quality cumulative impacts) (see Section 3.2.1)
- Perception that current proposal is a continuation of existing activity, not an increase in activity (comment noted)
- Testing of GRBAC preliminary recommendations (NEPA streamlining); cumulative impacts (air quality, forest, transportation, etc.) (comment noted)
- Use of CEQ handbook to analyze cumulative impacts (see Chapter 4.0)

2.0 PROPOSED ACTION AND ALTERNATIVES

Four alternative actions are evaluated in this EIS:

- the Proposed Action (450 well locations--see Section 2.1);
- Alternative A (sensitive resource area protection alternative--see Section 2.2);
- Alternative B (maximum well location density alternative--see Section 2.3); and
- the No Action Alternative (see Section 2.5).

Additional alternatives were considered but rejected, including an alternative with a 16-well per section spacing pattern (i.e., 1 well location/40 acres).

Drilling operations are currently underway in the J2PA on well locations within the original Jonah Project Area previously approved by the BLM PRA (BLM 1994b). On completion of the 1996 drilling season, the Operators had drilled approximately 30 natural gas wells within the J2PA and adjacent areas, 29 of which were completed as producing wells. Forty-nine well locations and associated access roads and pipelines currently exist or have been authorized on the J2PA (Map 2.1). Drilling and production operations will continue in the J2PA during the NEPA process as authorized by the Decision Record (DR) and Finding of No Significant Impact for the *Jonah Prospect Field Natural Gas Development EA/DR* (Jonah EA/DR) (BLM 1994b), and for field delineation under the authority of the Memorandum of Understanding for this project.

This project entails the development of natural gas resources in the J2PA beginning in 1997 and continuing for approximately 10 to 15 years. Well spacing patterns would likely vary across the J2PA, and spacing would likely range from 640 acres/well (one location per 640-acre section) to 80 acres/well (eight locations per section). A 40 acres/well spacing may be authorized in areas adjacent to state mineral estate to protect the federal gas reserves from depletion.

The types, locations, and acreages of existing and authorized surface disturbance in the J2PA are presented in Map 2.1 and Table 2.1. Table 2.1 also illustrates the approximate level of surface disturbance required under the Proposed Action, No Action Alternative, and other development alternatives (Alternatives A and B).

2.1 THE PROPOSED ACTION (450 Well Locations)

The Proposed Action is to drill and develop up to 450 well locations and related roads, pipelines, and ancillary facilities within the J2PA in addition to existing operations and currently approved proposals described in the Jonah EA (BLM 1994b). Drilling would begin in 1997 and continue at the rate of approximately 30 wells/year until:

- the total number of proposed wells have been drilled;
- the natural gas resources in the field have been fully developed; or
- economic conditions are such that it is no longer profitable to drill additional wells.

The estimated life of the project (LOP) is 40-50 years.

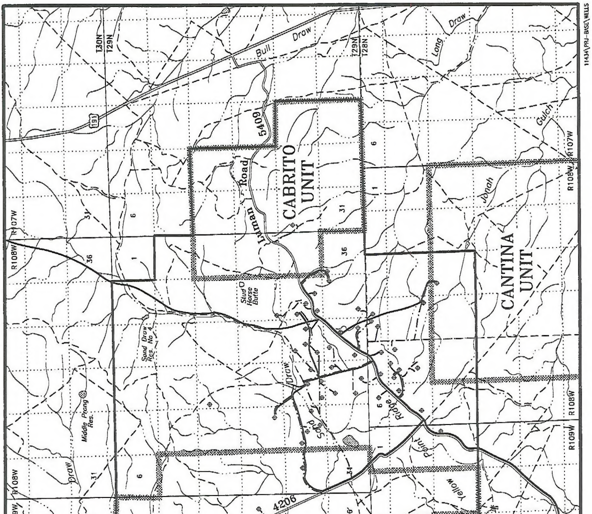
Existing and authorized surface disturbance from roads (including unimproved and two-track routes), well locations, pipelines, and ancillary facilities is approximately 457 acres. The Proposed Action would result in 2,927 acres of new surface disturbance, including:

- 450 well locations - 1,125 acres (2.5 acres/location);
- 180 mi of new road construction with adjacent pipelines - 1,527 acres;
- widening approximately 17 mi of the Burma and Luman Roads - 121 acres;
- four compressor stations - 16.0 acres (4.0 acres each);
- 10 water wells - 5 acres; and
- 22 mi of sales pipeline outside the J2PA - 133 acres (Table 2.1).

Following reclamation of disturbed areas not necessary for field operations, LOP surface disturbance resulting from the Proposed Action would be 1,086 acres, including 152 acres of existing disturbance.

2.2 ALTERNATIVE A - 420 WELL LOCATIONS (Sensitive Resource Protection)

Alternative A involves a reduction in surface disturbance based on sensitive resource protection. Surface disturbance throughout the entire J2PA resulting from Alternative A would be reduced from



Map 2.1 Existing and Authorized Disturbance, Jonah Field II Project, Sublette County, Wyoming, 1997.

Table 2.1 Types and Acreages of Surface Disturbance, Jonah Field II Project, Sublette County, Wyoming, 1997.

		Acres of Disturbance							
	Existing Acres	Proposed Action (450 Locations)[2]		Alternative A (420 Locations)[3]		Alternative B (327 Locations)[4]		No Action[5]	
Disturbance Type	Disturbance[1]	New	LOP[6]	New	LOP[6]	New	LOP[6]	New	Long-term[6]
Well locations	122	1,125	315	1,050	294	842	236	0	0
Access roads/gathering pipelines[7]	64	1,527	524	1,425	489	1,145	393	0	0
Burma and Luman Roads[8]	50	121	74	121	74	121	74	0	0
Other roads	84	0	0	0	0	0	0	0	0
Compressor stations	2	16	16	16	16	16	16	0	0
Water wells	2	5	5	5	5	5	5	0	0
Sales pipeline[9]	133	133	0	133	0	133	0	0	0
Subtotal	457	2,927	934	2,750	878	2,262	724	0	0
Existing[10]	NA	323	152	323	152	323	152	457[11]	236[12]
Total Acres	457	3,250	1,086	3,073	1,030	2,585	876	457	236

1 Includes 122 acres disturbance from 49 well locations (2.5 acres initial disturbance/location); 64 acres from existing roads and gathering pipelines; 50 acres from the Burma and Luman Roads (17 mi total); 84 acres from other unimproved roads (approximately 58 mi with an estimated 12 ft average disturbance width); 2 acres from existing compression facilities, 2 acres from existing water wells, and 133 acres from the existing sales pipeline.

2 Is consistent with the Proposed Action and assumes surface disturbance from 450 new well locations; 180 mi of new roads and gathering pipelines; improvements to the Burma and Luman Roads; a maximum of four new 4-acre compression facilities; and 22 mi of new sales pipeline outside of the J2PA (50-ft disturbance width).

3 Assumes a reduction in surface disturbance due to the exclusion of development on sensitive resource areas, and includes 420 well locations and 168 mi of new roads and gathering pipelines. Other project features would remain unchanged from the Proposed Action.

4 Assumes a maximum of 337 well locations and 135 mi of new roads and gathering pipelines. Other project features would remain unchanged from the Proposed Action.

5 Assumes no new development on the J2PA.

6 Life of Project (LOP) is assumed to be 40-50 years and includes long-term surface disturbance of 0.7 acres/location, 24-ft disturbance width for roads and adjacent pipelines and 36-ft disturbance width for the Burma and Luman Roads.

7 Assumes a 75-ft ROW, 70-ft initial disturbance width, and 24-ft LOP disturbance width.

8 Assumes an existing 24-ft disturbance width, a 60-ft disturbance width for road improvements, and a LOP disturbance width of 36 ft for the approximately 17 mi of these roads on the J2PA.

9 Assumes a 50-ft ROW and disturbance width (initial) for the entire 22-mi length of the sales pipeline outside the J2PA; the entire disturbed area would be reclaimed as soon as practical following disturbance; other sales pipelines were approved in the Jonah EA (BLM 1994b).

10 Includes 49 well locations, 20 mi of access roads and gathering lines, compressor stations, water wells, and sales pipelines necessary for the action listed.

11 Includes all existing disturbance on the project area.

12 Includes only long-term existing disturbance on the project area.

that of the Proposed Action due to Conditional Surface Use (CSU) restrictions applied on federal lands within a 0.5-mi area surrounding active raptor nests and sage grouse leks (4,021 acres) (Map 2.2 and Table 2.1). CSU restrictions, under this alternative, would include the denial of well locations, roads, or other construction activities that result in the establishment of surface facilities requiring repeated human presence. Construction that results in facilities not requiring repeated human presence (e.g., pipelines) may be authorized within CSU areas (i.e., within 0.5 mi of active leks and nests). This CSU restriction has been established based on public comments that indicate current BLM seasonal use restrictions may not adequately protect sage grouse leks and raptor nests. Directional drilling from locations outside of CSU areas may be used to access natural gas reserves beneath these areas. In addition, no major project activities (e.g., construction, drilling, workovers) would be allowed during crucial raptor and sage grouse breeding and nesting periods (e.g., February 1 through July 31 for raptors and March 1 through June 30 for sage grouse) within 1.0 mi of these features under this alternative.

It is assumed that reductions in surface disturbance and associated activities proximal to active leks and nests would result in reductions in impacts (both direct and indirect) to these resources. Since the locations of active nests and leks would change over time, nests and leks would be considered active if they have been used within the last three years, and the BLM, WGFD, and/or a qualified biologist hired by the Operators would conduct annual raptor and sage grouse lek surveys of the area to determine nest and lek activity status.

Since approximately 4,021 acres of the J2PA is within 0.5 mi of known active raptor nests and/or sage grouse leks, it is assumed that surface disturbance in the J2PA would be reduced by approximately 6% (i.e., rounded to 420 new well locations). Alternative A would therefore result in an estimated maximum of 2,750 acres of new initial disturbance and 878 acres of new LOP surface disturbance. Total long-term disturbance on the J2PA for the LOP (including 152 acres of existing disturbance required for the project) would be 1,030 acres, or 5% less than that of the Proposed Action.

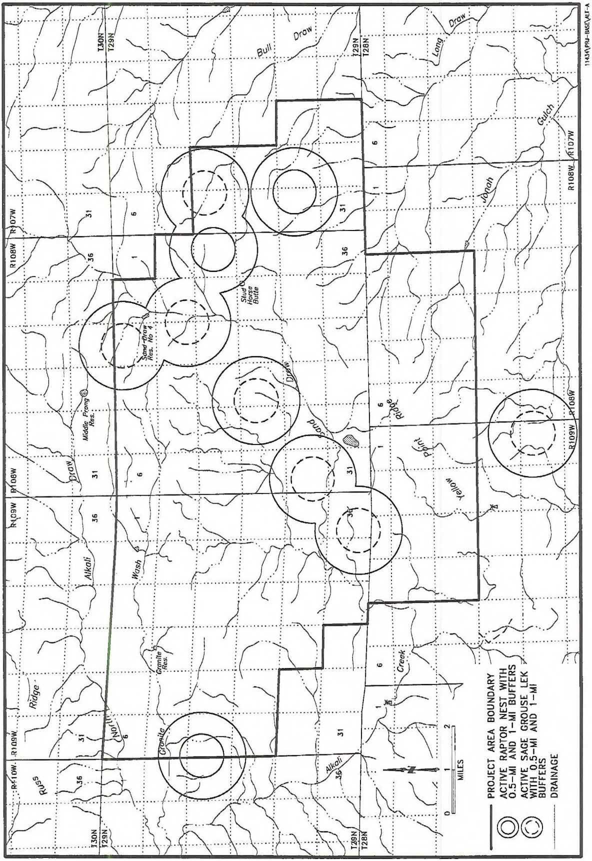
2.3 ALTERNATIVE B - 327 WELL LOCATIONS (Maximum Density of 4 Well Locations/Section)

Under Alternative B, a maximum of four well locations per section (160-acre spacing) would be allowed throughout the J2PA. However, in areas where federal gas reserves are potentially being depleted from wells located on state sections, higher well densities would be authorized.

Since a maximum of approximately 327 new well locations (i.e., four locations per section in all areas of the J2PA where this location density has not yet been reached) would be developed under Alternative B, new and LOP surface disturbance would be reduced from that of the Proposed Action. An estimated maximum of 2,262 acres of new initial disturbance and 724 acres of new LOP surface disturbance would be required, or 23% less than that of the Proposed Action. Total long-term disturbance on the J2PA for the LOP (including 152 acres of existing disturbance required for the proposed project) would be 876 acres, or 19% less than that for the Proposed Action and 15% less than that for Alternative A.

2.4 ACTIONS COMMON TO ALL ALTERNATIVES

Drilling operations would continue year-round with up to four drilling rigs operating simultaneously. Workers, materials, and equipment would be transported to the project area over U.S. Highway 191, State Highway 351, and BLM Roads 4206 (Burma Road) and 5409 (Luman Road). An estimated 441 round trips would be required to construct, drill, complete, and tie in each well, whereas during production, 7,289 round trips per location would be necessary for maintenance (each location would be visited daily and 37 locations would be visited each trip) (Table 2.2). An estimated maximum of approximately 150 round trips per day would occur during construction and drilling (four operational rigs), and an estimated maximum of 10 round trips per day would occur during operations (450 producing wells). Construction workers, rig crews, and support personnel would be housed in Pinedale, Boulder, Big Piney, Marbleton, LaBarge, and Eden/Farson areas, eliminating the need for a worker camp or temporary housing in the project area. Other support personnel (e.g., cementing, fracturing, and/or perforating crews) would likely be based out of Rock Springs and would commute.



Map 2.2 Sensitive Resource Areas for Alternative A, Jonah Field II Project, Sublette County, Wyoming, 1997.

Table 2.2 Estimated Traffic Requirements, Jonah Field II Project, Sublette County, Wyoming, 1997.[1]

Type of Traffic	Round Trips per Well Location	LOP Round Trips (1,000s) Required for Maximum Development
Well construction and development		
Construction (5 days/location and access road)	50	23
Gravel hauling	33	15
Rig transportation/setup (4 days/well)	60	27
Drilling (20 days/well)	133	60
Completion (15 days/well)	145	65
Pipeline and ancillary facility installation (5 days/location)	20	9
Total well construction and development (49 days/location)	441	199
Operations and maintenance		
Production	197[2]	109[3]
Workovers (10 days every 10 years/well)	60	27
Total operations/maintenance	257	136
Abandonment and reclamation (5 days/location)	50	23
Sales pipeline	--	1
Compressor station	--	1
GRAND TOTAL	--	360

1 Assumes all 450 wells are drilled and completed as producers, wells produce every day, well life is 20 years, and the LOP is 40 years.

2 Assumes a productive life of 20 years per well and one pumper per 37 wells per day.

3 Assumes two full-time production foremen and two full-time field clerks in addition to pumpers.

Table 2.3 provides the estimated workforce requirements associated with the project. Construction, drilling, completion, and production of 450 wells would require an estimated 2,039 worker-years.

Operators would comply with existing federal, state, and county requirements and restrictions developed to protect road networks and the traveling public. Special arrangements would be made with the Wyoming Department of Transportation (WDOT), as required, to transport oversize and/or overweight loads to the project area. The transportation planning process for this project is described in Appendix A.

2.4.1 Preconstruction Planning and Site Layout

Pursuant to Onshore Oil and Gas Orders Nos. 1 and 2, each proposed well would require an APD approved by BLM prior to any surface disturbance. Each APD would contain site-specific information regarding all facets of well development including environmental concerns, and a site-specific EA would be prepared for each APD. The Operators and/or their contractors and subcontractors would conduct all phases of project implementation, including well location, road and pipeline construction, drilling and completion operations, maintenance, reclamation, and abandonment in full compliance with all applicable federal, state, and local laws and regulations and within the guidelines specified in approved APDs, ROW permits, and site-specific EAs and DRs. Lessees and operators would be fully accountable for their contractor's and subcontractor's compliance with the requirements for the approved permit and/or plan. Access roads and pipelines constructed and/or used by the Operators would require ROW authorizations.

2.4.2 Well Pad and Road Construction

2.4.2.1 Well Pads

Major components of each individual well pad include:

- a level area for placement/support of the drilling rig and related equipment, production facilities, and storage tanks;
- an earthen reserve pit to contain drilling fluids, drilled cuttings, and fluids produced during the drilling operation; and
- an earthen flare pit for the safe ignition of flammable gases produced during drilling, completion, and testing operations.

The entire well pad area would be cleared of all vegetation, and up to 12 inches of topsoil would be removed from all areas of cut, fill, and/or subsoil storage. Topsoil would be stockpiled for future use in reclamation. After the topsoil has been removed, the pad would be graded to prepare a level working surface. Each well location would be designed so that the amount of cut and fill material would "balance," where feasible, thereby minimizing the need to stockpile excess subsoil adjacent to the well location until site reclamation. Materials excavated from the reserve pit would be stockpiled adjacent to the reserve pit and used to backfill the pit during reclamation.

The leveled area required for drilling and completion of each well would be approximately 2.25 acres. In addition, an average of 0.25 acres would be required for cut/fill slopes and subsoil stockpiles, resulting in total average surface disturbance of 2.5 acres/well. Well pad and access road construction would take five days per location and would require four workers (20 worker-days) (see Table 2.3). Services would be provided by local contractors.

Erosion control would be maintained through prompt revegetation and by constructing surface water drainage controls such as berms, diversion ditches, and sediment ponds as necessary at each well location according to the Reclamation Plan (Appendix B). All diversion ditches and other surface water and erosion control structures at each location would be shown on topographic relief maps provided with each APD. Stormwater Pollution Prevention Plans (SWPPPs) would be prepared for all well locations, access roads, and other disturbances of more than 5 acres in compliance with the WDEQ.

2.4.2.2 Roads

New road construction would average approximately 0.4 mi/location (1.9 acres disturbance/location initially [40-ft disturbance width] and 1.2 acres disturbance/location for the LOP [24-ft disturbance width]). Roads would be designed by a licensed professional engineer if deemed necessary by the BLM, and all roads would be built in accordance with guidelines established for oil and gas exploration and development activities in BLM Manual Section 9113

Table 2.3 Estimated Workforce Requirements for 450 Wells, Jonah Field II Project, Sublette County, Wyoming, 1997.[1]

Employment Category	Worker-days per Well	Total Worker-years for Project[2]
Well construction and development (49 days)		
Construction (5 days x 4 workers)	20	35
Rig transportation/setup (4 days x 15 workers)	60	104
Drilling (20 days x 7 workers x 3 shifts)	420	727
Completion (15 days x 11 workers)	165	286
Pipeline and ancillary facility installation (5 days x 6 workers)	30	52
Operations and maintenance (20 years)		
Production	195[3]	498[4]
Workovers[5] (every 10 years) (10 days x 7 workers)	140	242
Abandonment and reclamation (5 days x 10 workers)	50	87
Sales pipeline (45 days x 15 workers)	--	3
Compressor station (60 days x 20 workers)	--	5
Total	1,080	2,039

1 Assumes that all 450 wells are drilled and completed as producers.
2 260 worker-days = 1 worker-year.
3 One pumper/37 wells/day and a productive life of 20 years per well.
4 Assumes two full-time production foremen and two full-time field clerks in addition to pumpers.
5 Assumes two workovers per well.

(BLM 1985, 1991a). On completion of construction activities, the engineer would certify that the road was constructed in accordance with the approved road construction design, if deemed necessary by the BLM. Any deficiencies would be corrected in order to ensure compliance with the both the approved Road Construction Plan and the APD. Once road construction is complete, all but 24 ft of the ROW would be reclaimed and revegetated. In addition, road construction, upgrading, maintenance, and reclamation activities would be planned in accordance with the Transportation Plan for this project (see Appendix A).

Aggregates used for road and well location construction would be acquired from commercial sources primarily on federal and state lands on and adjacent to the project area. Prior to aggregate extraction, appropriate permits would be obtained from the BLM and/or WDEQ/Land Quality Division (LQD), as appropriate. Aggregates would be free of noxious weeds.

2.4.3 Drilling Operations

An estimated one to four rotary drilling rigs rated for drilling to depths of 12,000 ft or more would be used. Rig transport and on-site assembly for each well location would take 4 days and require 15 workers (see Table 2.3) and 60 round trips per location (see Table 2.2). Drilling operations would take 20 days per well and require 21-22 workers. Drilling rig workers either would be local or would find temporary lodging in a nearby town. Figure 2.1 presents a schematic representation of a typical well pad layout during drilling.

The drilling operation would utilize a water-based mud system with additives to minimize downhole problems. Drilling would require approximately 1.5 barrels (bbl) of water (42 gal/bbl) per ft of hole drilled--an average of 18,000 bbl of water (2.3 acre-ft) per well location (approximately 860 bbl of water/rig/day). With four rigs drilling simultaneously, water requirements may be as great as 3,440 bbl of water/day. Drilling water would be obtained from one or more of six primary sources:

1) the Jonah #1-4W water well in NE¼SW¼ of Section 4, T28N, R108W (Permit #UW-87834), which produces 90 gal of water/minute and has on-site storage capacity of 600 bbl (two 300-bbl steel tanks);

2) the Jonah #16-20 water well in SE¼SE¼ of Section 20, T29N, R108W (Permit #UW-99142), which produces 90 gal of water/minute and has on-site storage capacity of 400 bbl (one 400-bbl steel tank);

3) the Stud Horse Butte #13-27W water well in SW¼SW¼ of Section 27, T29N, R108W (Permit #UW-103561), which produces 90 gal of water/minute and has on-site storage capacity of 400 bbl (one 400-bbl steel tank);

4) the Ultra water well in SW¼SW¼ of Section 23, T29N, R108W;

5) the McMurry well in NE¼SW¼ of Section 26, T29N, R108W; and

6) additional water wells to be drilled on existing well pads at strategic locations throughout the project area and provided with steel tanks for on-site storage, contingent upon approval of an *Application for Permit to Appropriate Ground Water* by the Wyoming State Engineer and an approved APD by BLM.

Water and drilling additives would be contained in reserve pits, which would be lined as directed by the BLM to conserve water and protect near-surface water aquifers. If diesel is used in the mud, it would be recovered in tanks before it gets into the reserve pit. Trenches around the drilling rig would have siphons installed to prevent any oil and grease that is washed off the rig from entering the reserve pit. Reserve pits would be lined with synthetic materials where potassium chloride or other undesirable materials are proposed for use in drilling or fracturing fluids. In addition, siphons would be constructed at each reserve pit to collect, as necessary, any undesirable materials that may enter the pits. Reserve pits would be fenced on the three nonworking sides during drilling to protect wildlife and livestock, and on the fourth side immediately following removal of the drilling rig. Fencing would be installed in accordance with BLM/USFS/WGFD guidelines and maintained until the reserve pit is backfilled. Netting (1-inch mesh) would be placed over reserve pits containing

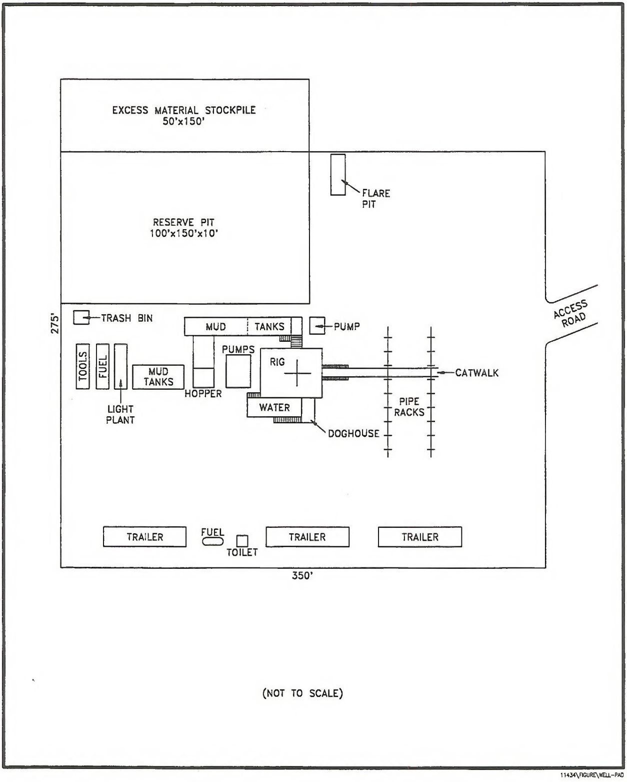


Figure 2.1 Typical Well Pad Layout During Drilling, Jonah Field II Project, Sublette County, Wyoming, 1997.

hydrocarbons or other substances toxic to wildlife, in compliance with BLM Informational Bulletin Number WY-93-054.

Surface casing would be set to a depth adequate to isolate near-surface freshwater aquifers (an estimated 2,500 ft) (Figure 2.2). Production casing would be run and cement circulated to a minimum of 400 ft above the Lance Formation, effectively isolating all geologic formations and eliminating any fluid migration between hydrocarbon-bearing zones and freshwater aquifers.

Some Operators are exploring the possibility of utilizing drilling rigs with engines converted to burn natural gas rather than diesel fuel. Natural gas would be supplied by producing wells within the project area and would be transported to the drillsite through temporary surface pipelines. Use of natural gas would reduce fuel costs and exhaust emissions; however, the availability of drilling rigs fueled by natural gas is extremely limited and the possibility of their use in the area is uncertain at this time.

2.4.4 Completion and Evaluation Operations

Once the well has been drilled and cased, a completion (workover) unit typically would be moved onto the well location to clean the well bore, conduct pressure testing, and perforate the potentially productive downhole formations. After the casing is perforated, the targeted downhole zones (i.e., the Lance Formation) would be fracture-stimulated. A typical "frac" contains 2,500 bbl of fluid and 500,000 pounds of proppant, which is pumped down the hole under high pressure and forced through the perforations in the casing and into the formation. As the formation is fractured, the resultant fissures (fractures) are filled with the proppant, which holds the fissures open and facilitates the flow of gas into the wellbore and through the production tubing to the surface. Multiple fracs may be performed on each wellbore.

On completion of the frac job, the well is flowed back to the surface (2 to 3 days) in an attempt to recover as much of the frac fluid as possible and to clean excess proppant out of the perforations. Production tubing would be set, if warranted, prior to installing production equipment and placing the well "on line." All frac fluid additives would meet BLM/EPA requirements for disposal of oil field wastes. All fluids utilized in the completion procedure would be contained on the well location in pits or tanks and disposed of in compliance with state and federal rules and regulations. Gases produced in association with completion and testing would be diverted to an unlined flare pit.

Approximately 2,250 to 10,000 bbl of water (0.3 to 1.3 acre-ft) would be needed for completion and testing of each well, and this water would come from the same locations as specified for drilling operations (see Section 2.4.3). The maximum total water requirement for drilling, completion, and testing operations at each well would be 28,000 bbls (3.6 acre-ft). Water requirements for 450 wells may be as great as 12.6 million bbls (1,620 acre-ft). Completion and testing would require 11 workers for 15 days (Table 2.3), and workers would likely be from Rock Springs, Big Piney, or LaBarge.

2.4.5 Production Operations

After well completion operations, production equipment would be set, gathering pipelines installed, and the well placed on line, with production continuing as long as the well is capable of commercial production and a demand for the gas exists. Production equipment typically would include: a "christmas tree" at the well head (a series of valves designed to control pressures and regulate flows from the well); a high pressure (600 pounds per square inch [psi]) separator which feeds into a low pressure (25 psi) separator designed to lower VOC emissions; one or two aboveground 300-bbl tanks for condensate storage; an aboveground 160-bbl steel or fiberglass tank for produced water containment or an underground tank with a BLM-approved leak detection system; a 500-gal methanol tank and pump; a glycol dehydrator and pump; and a meter run for measurement of gas volumes produced into the pipeline. Installation of these facilities would require a maximum of six workers for 5 days. All aboveground production facilities would be painted a standard environmental color (e.g., Carlsbad Canyon) that blends with the surrounding landscape, except for structures that require safety coloration to comply with Occupational Safety and Health Administration (OSHA) regulations. A typical production facility layout is shown in Figure 2.3.

Natural gas production from wells in the project area is expected to range from 0.5 to over 5.0 million

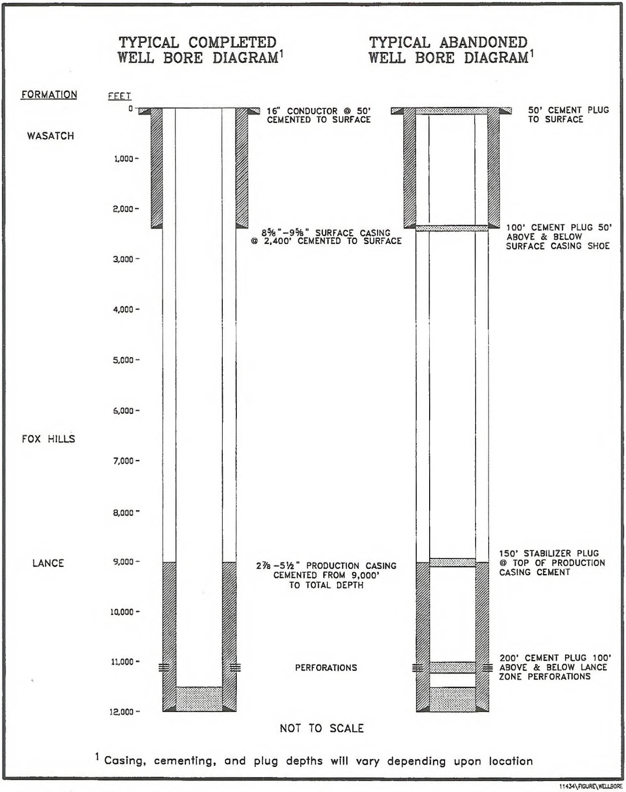


Figure 2.2 Typical Completed and Abandoned Well Bore Diagram, Jonah Field II Project, Sublette County, Wyoming, 1997.

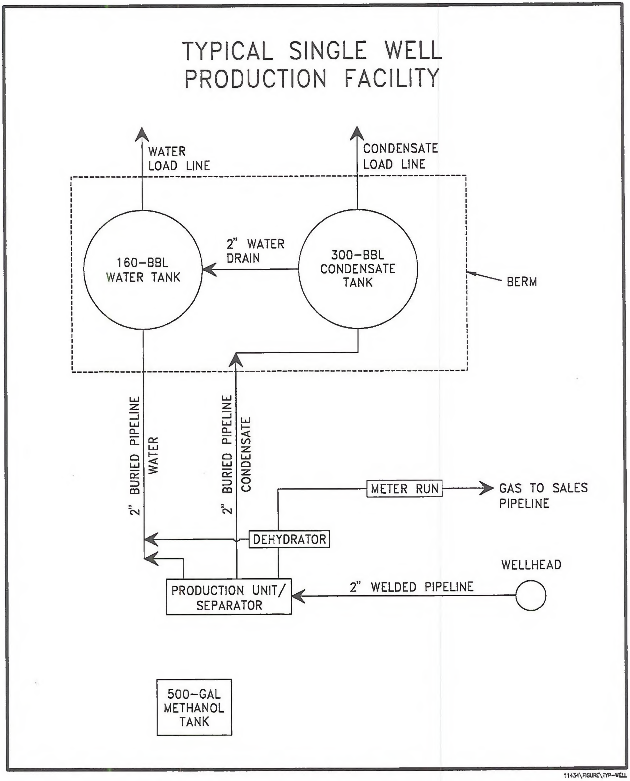


Figure 2.3 Typical Well Location Production Facility, Jonah II Field Project, Sublette County, Wyoming, 1997.

cubic ft (mmcf) per day (mmcfpd), with average production field-wide expected to be 2-3 mmcfgpd per well. The composition of three gas samples taken from the field indicates that the major component (88.14-91.32% by weight) is methane, followed by ethane (5.09-6.49%), propane (1.60-2.35%), and lesser amounts of several other gases (Table 2.4). No hydrogen sulfide is known to occur in natural gas from the J2PA, and none is expected to be encountered during project operations.

Condensate production from each well is expected to average from 5 to 45 bbl/day (i.e., an estimated 9 bbl/thousand cubic feet [mcf] of gas produced). Condensates consist primarily of long chain hydrocarbon liquids (e.g., pentanes, hexanes, heptanes, octanes) (Table 2.5) and would be stored in tanks at each well location. All tank batteries would be fenced and bermed to contain 110% of the volume of the largest tank. Condensates would be removed from storage tanks on a periodic basis as needed and transported by truck for sale. Best available control technologies (BACTs) would be used to reduce VOC emissions from condensate storage tanks.

Produced water would average from 0.5 to 10.0 bbl of water/day at each well. Water would be removed from the gas stream by the separators and dehydration and would be stored in a tank at each location, from which it periodically would be removed and disposed of in accordance with BLM/WOGCC/WDEQ rules and regulations. Produced water would be trucked to an approved disposal site (e.g., a well owned and operated by Enron Oil & Gas Company, Green River Bend #1, located in the SW¼NW¼ of Section 36, Township 27 North, Range 113 West) for underground disposal. The Jonah Federal 3-15 shut-in well (NE¼NW¼ of Section 15, Township 28 North, Range 108 West) or another appropriate wellbore may be converted for use as a disposal well, or a new disposal well may be drilled in the J2PA to meet produced water disposal needs. Prior to such conversion or drilling, Operators would obtain approval from both the BLM and WOGCC in compliance with Onshore Oil and Gas Order Nos. 1, 2, and 7, as well as WOGCC Underground Injection Control rules and regulations (WOGCC Rule 405) governing the subsurface disposal of produced water.

The composition of produced water from four wells in the field indicates that water quality between wells can be highly variable; for instance, total dissolved solids (TDS) ranged from 2,750 to 16,850 mg/l, and chloride from 670 to 10,000 mg/l (Table 2.6).

Routine on-site maintenance operations at each producing well generally would include a daily visit by a worker (pumper) who monitors the overall operation of the well and makes adjustments as required to ensure its efficient operation. Six workers would take 5 days to install pipelines and ancillary equipment at each well (see Table 2.3). An average of one worker day per 37 wells would be required during production, and one workover every 10 years would require seven workers for 10 days. The estimated employment requirements for well operations are presented in Table 2.3, and traffic requirements are presented in Table 2.2. The productive life of a well in the project area is expected to be 20 years.

Reclamation of areas unnecessary for production operations--approximately 1.8 acres at each well location--would be completed prior to freeze-up following termination of drilling and completion operations and a full drying season, thereby reducing surface disturbance at each location to 0.7 acres for the LOP. All disturbed surfaces would be reclaimed as soon as possible after initial disturbance. Reclamation would include backfilling the reserve pit, leveling and recontouring disturbed areas, redistribution of stockpiled topsoil over disturbed areas, and reseeding as recommended by the appropriate regulatory agency (BLM or WOGCC).

Reclamation of the reserve pit would occur when the pit is no longer required for completion and/or testing. Free-standing water in the pit would be evaporated prior to the commencement of backfilling.

2.4.6 Pipelines

Industry standard pipeline equipment, materials, techniques, and procedures in conformance with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of both gathering system and sales pipelines. Depending on the location of acceptable tie-ins, pipeline ROWS would be located adjacent to roads to the greatest extent possible to minimize surface disturbance and maximize construction and gas transport efficiency.

Table 2.4 Gas Composition Data, Jonah Field II Project, Sublette County, Wyoming, 1997.

	Percent by Weight		
Parameter	Sample 1	Sample 2	Sample 3
Methane	89.16	88.14	91.32
Ethane	6.02	6.49	5.09
Carbon dioxide	0.87	0.90	0.83
Propane	2.31	2.35	1.60
N-Butane	0.50	0.49	0.35
I-Butane	0.52	0.50	0.34
Nitrogen	0.17	0.52	0.18
I-Pentane	0.19	0.18	0.13
N-Pentane	0.17	0.12	0.10
Hexanes	0.09	0.32	0.06
Total	100.00	100.00	100.00

For large pipelines (>10 inches in diameter), sufficient topsoil (up to 12 inches) to facilitate reclamation would be removed and stockpiled from pipeline ROWs prior to ditching. On smaller pipelines, unless the pipeline route is on a steep sidehill, vegetation would be stripped to ground level using mechanical treatments that leave the topsoil intact and minimize disturbance to plant root systems, thereby facilitating vegetation reestablishment. Pipeline trenches generally would be 2 to 3 ft wide and located 8 to 10 ft outside of the road outslopes (Figure 2.4). All trenches would be backfilled as soon as possible and compacted. To facilitate compaction, no vegetation or snow would be in the trench during backfilling, and trenches would be wheel-rolled at least twice.

All pipeline ROW reclamation would be initiated as soon as practical following disturbance, but would be completed within a maximum of one year following completion of pipeline installation. Reclamation would be in accordance with the Reclamation Plan (Appendix B).

All pipelines would be tested with natural gas or water to ensure the integrity of newly constructed lines. Testing would consist of filling pipeline segments and pressurizing to levels exceeding operating pressures. If leaks or ruptures occur, they would be repaired and testing would be repeated until successful. Natural gas used for testing either would be returned to the gathering system for sales or vented to the surface in accordance with Notice to Lessees (NTL)-4A and/or WOGCC Rule 340. Fresh water also would be used for pipeline testing, and on completion of testing, this water would be discharged to existing drainages at rates less than the existing capacity of the affected drainages. The discharge of hydrostatic test water would be in accordance with BLM guidelines established during ROW permitting.

2.4.6.1 Gathering System

Natural gas would be transported in buried pipelines from each producing well location to the nearest existing gathering line. Gathering lines are anticipated to be 3 to 12 inches in diameter. Pipelines would

Table 2.5 Representative Example of Condensate Content, Jonah Field II Project, Sublette County, Wyoming, 1997.[1]

Component	Volume Percent
Hexanes[2]	90.3
n-Butane	2.2
i-Pentane	2.0
n-Pentane	1.8
i-Butane	1.5
Propane	1.5
Ethane	0.3
Carbon dioxide	0.1
Other[3]	0.3
Total	100.0

[1] Adapted from Empact Analytical Systems, Inc., Extended Light Crude Analysis, Stud Horse Butte 5-26.
[2] Includes benzene (0.4%), toluene (2.6%), ethylbenzene (0.3%), xylene (3.6%), and other long-chain hydrocarbon liquids.
[3] Includes nitrogen, methane, and 2,2 dimethylpropane.

follow roads to the greatest extent possible to minimize surface disturbance. The maximum width of gathering system pipeline ROWs would be 35 ft outside of and adjacent to road ROWs (50 ft total pipeline ROW width), and an average 0.4 mi of buried pipeline would be required per well. A typical access road with adjacent gathering pipeline is shown in Figure 2.4.

2.4.6.2 Sales Pipelines

Two sales pipeline corridors currently are used to transport natural gas produced in the area to market. These corridors and their respective ROW routes were analyzed and approved in the Jonah EA/DR (BLM 1994b). As additional natural gas production occurs, the Operators anticipate that additional pipelines and/or larger replacement pipelines would be required to increase gas carrying capacity. For this project, it is anticipated that an additional pipeline would be located within the existing pipeline corridor running southwest of the J2PA, and buried and surface pipelines would be replaced in the existing corridor running north of the J2PA (Map 2.3). It is estimated that construction of 22 mi of new sales pipeline outside the J2PA would require 15 workers for 45 days and that workers would be hired from the local workforce. A typical sales pipeline ROW is shown in Figure 2.5.

There are no plans at this time to install additional sales lines from the project area to connections with existing interstate gas transmission lines; however, two gas transportation companies are currently exploring the possibility of running pipelines into the area.

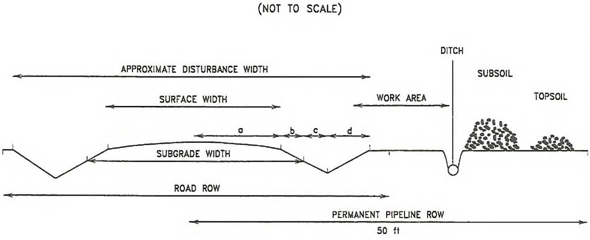
2.4.7 Abandonment and Reclamation

As producing wells within the gas field become noncommercial, Operators would obtain the necessary authorizations from the appropriate regulatory agencies to abandon wells. All aboveground facilities would be removed, the wellbore would be physically plugged (see Figure 2.2), buried pipelines would be purged and abandoned in place, and both the abandoned road and well location would be reclaimed according to BLM and/or WOGCC recommendations and guidelines in the Reclamation Plan (Appendix B).

Table 2.6 Water Quality from Four Existing Wells and Relevant Class III Groundwater Quality Standards, Jonah Field II Project, Sublette County, Wyoming, 1997.

Water Quality Parameter	WDEQ Class III Underground Water Quality Standard[1]	Concentration (milligrams/liter)			
		Sample 1	Sample 2	Sample 3	Sample 4
pH[2]	6.5-8.5	6.46	5.84	5.57	6.38
Total dissolved solids	5,000	3,990	2,828	2,750	16,850
Chloride	2,000	2,200	1,400	670	10,000
Sulfate	3,000	26.9	46.9	76.9	17.0
Aluminum	5.0	0.66	0.33	1.27	15.6
Cadmium	0.05	<0.001	<0.001	<0.001	<0.001
Chromium	0.05	<0.001	<0.001	<0.001	0.014
Copper	0.5	<0.01	<0.01	<0.01	0.05
Lead	0.1	<0.07	<0.07	<0.07	1.16
Mercury	0.005	<0.001	0.002	0.005	<0.001
Arsenic	0.2	<0.003	<0.001	0.008	<0.006
Selenium	0.05	0.001	<0.002	<0.002	0.005
Zinc	25	0.07	0.06	6.9	0.15
Calcium	--[3]	25.7	29.1	81.9	1,380
Bicarbonate	--[3]	500	103.8	0	520
Carbonate	--[3]	0	0.2	10,660	0
Sodium	--[3]	1,220	677	609	3,380

[1] From WDEQ (1980).
[2] pH reported in standard pH units.
[3] -- = No WDEQ standards for Class III groundwater.



	MINIMUM SUBGRADE WIDTH (ft)	MINIMUM SURFACED TRAVELWAY WIDTH (ft)	a (ft)	b (ft)	c (ft)	d (ft)	APPROXIMATE DISTURBANCE WIDTH (ft)	ROW WIDTH (ft)	DESIGN SPEED (mph)
RESOURCE ROAD	16	12	6	2	4	8	40	50	15–30
LOCAL ROAD	24	20	10	2	4	8	48	55	20–50
COLLECTOR ROAD	28	24	12	2	4	8	52	60	30–50

DIAGRAM OF TYPICAL TURNOUTS ON RESOURCE ROADS

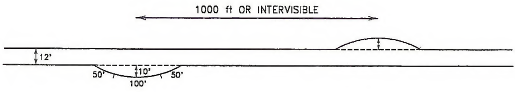


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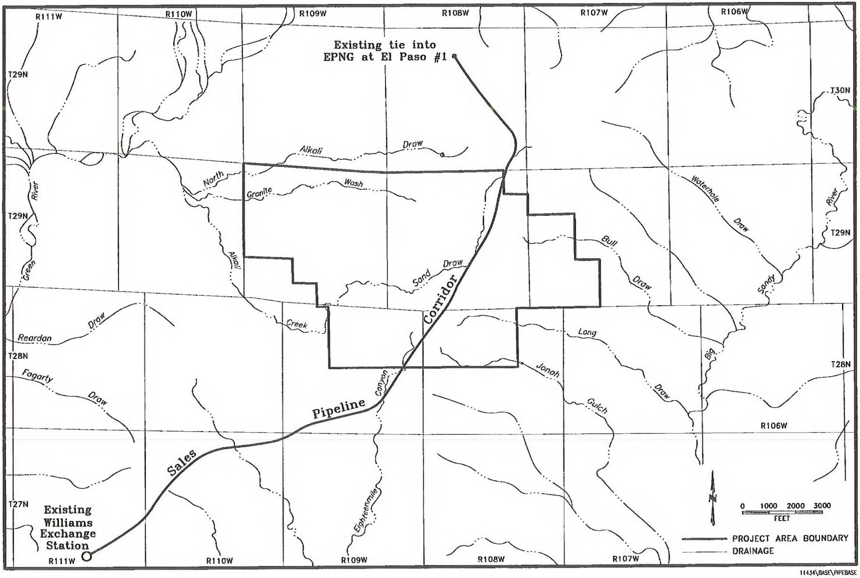
Figure 2.4 Typical Access Roads with Adjacent Gathering Pipeline, Jonah Field II Project, Sublette County, Wyoming, 1997.



Map 2.3 Existing and Proposed Sales Pipeline Routes (Routes Would be Parallel and Adjacent to Each Other), Jonah Field II Project, Sublette County, Wyoming, 1997.

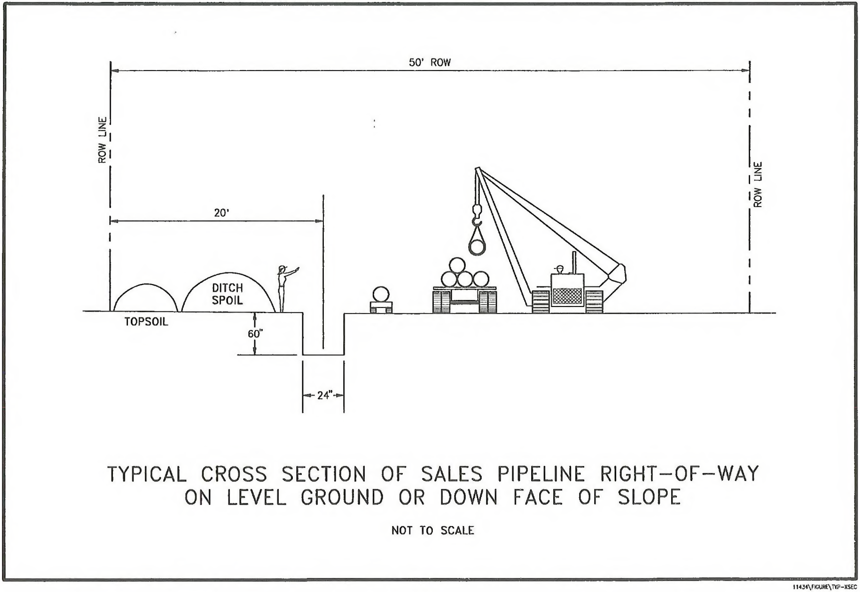


Figure 2.5 Typical Sales Pipeline ROW, Jonah Field II Project, Sublette County, Wyoming, 1997.

2.4.8 Ancillary Facilities

2.4.8.1 Compressors

Existing compression (approximately 3,000 horsepower [hp] authorized) within the area would be supplemented at the existing compressor site and with new compressor facilities (four total) to be constructed at undetermined locations within the J2PA. It is anticipated that additional compression (up to a maximum of 9,000 hp of new compression; 12,000 hp total) would be required to move the produced gas to market. The compressor stations would be situated and designed to minimize environmental impacts and maximize operational efficiency, and would require a maximum of 4.0 acres each for the LOP (16 acres maximum surface disturbance). Compressor engines would be fueled by natural gas and would be designed to minimize emissions using BACTs per WDEQ-Air Quality Division (AQD) requirements. A typical stack height would be 16 ft at a minimum. Approximately 20 workers would be required for 60 days to construct the compressor stations.

2.4.8.2 Water Wells

Water wells would be drilled from natural gas well locations. They would be 600-700 ft deep, and approximately one well would be required per nine to 16 sections (10 total new water wells at 0.5 acre surface disturbance/well).

2.4.9 Geophysical Operations

Geophysical operations (i.e., seismic surveys), including 3-D surveys, velocity surveys, normal incident vertical seismic profiles, and/or offset vertical seismic profiles may be required as drilling activity expands into portions of the J2PA with marginal or unknown gas reserves. No geophysical operations are currently proposed; however, if they are, a separate NEPA environmental analysis would be conducted. Surveys would be approved by the BLM prior to implementation using procedures specified in the BLM's PRA and GRRA RMPs. Cultural resource inventories and other surveys for sensitive environmental resources would be conducted prior to implementation of geophysical operations as directed by the BLM.

2.4.10 Hazardous Materials

The Operators have reviewed the EPA's Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 (as amended) to identify any hazardous substances proposed for production, use, storage, transport, or disposal by this project, as well as the EPA's List of Extremely Hazardous Substances as defined in 40 CFR 355 (as amended) and determined that numerous materials listed as hazardous and/or extremely hazardous would be used or generated by this project. This information is presented in Appendix C.

Hazardous materials anticipated to be used or produced during the implementation of the proposed project generally can be included in the following categories: drilling materials; casing and cementing materials; fracturing materials; production products; fuels; combustion emissions; and miscellaneous materials (see Appendix C for a complete list of the hazardous materials proposed for use and production during this project).

Operators and their contractors/subcontractors would comply with all applicable hazardous material laws and regulations and would locate, handle, and store hazardous substances in an appropriate manner to prevent them from contaminating sensitive resources. Any release of hazardous substances (leaks, spills, etc.) in excess of the reportable quantity as established by 40 CFR 117 would be reported as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. If the release of a hazardous substance in a reportable quantity does occur, a copy of the report would be furnished to the BLM and all other appropriate federal and state agencies.

Each Operator also would prepare, under separate cover in conjunction with this EIS, and implement the following plans and/or policies, copies of which would be available for review at the BLM Rock Springs District Office:

- Spill Prevention, Control, and Countermeasure Plans (SPCCPs) for sites which have storage volumes above threshold levels pursuant to 40 CFR 112;
- Spill Response Plans (oil/condensate);

- an inventory of hazardous chemical categories pursuant to Section 312 of SARA, as amended; and
- Emergency Response Plans.

2.4.11 Applicant-Committed Mitigation/Environmental Protection Measures

The following applicant-committed mitigation measures, design features, and procedures would be implemented by Operators to minimize impacts to the environment. Exceptions to mitigation measures may be granted if a thorough analysis determines that the resource(s) for which the measure was developed would not be impacted by the proposed project. Further site-specific mitigation measures would be identified during APD and ROW application review processes.

To assure compliance with mitigation measures stipulated in this EIS and in APDs and ROW applications, each Operator would provide qualified individuals to oversee construction/drilling operations and to consult with the BLM on a case-by-case basis, as necessary, during field development.

All of the proposed applicant-committed mitigation/environmental protection measures identified in this section would be implemented on all lands within the J2PA, and these measures include all existing lease stipulations for the J2PA. Development activities on all lands would be conducted in accordance with all appropriate federal, state, and county laws, rules, and regulations.

2.4.11.1 Preconstruction Planning and Design Measures

1. Implementation of site-specific projects would be contingent on BLM receiving, for approval/acceptance, the following plans:
   - Surface Use Plan and/or Plan of Development; Transportation Plan (Appendix A); Reclamation Plan (Appendix B); Hazardous Material Summary (Appendix C); Wildlife Monitoring/Protection Plan (Appendix D); Biological Assessment (Appendix E); and site-specific APD plans/reports (e.g., road and well pad design plans, cultural clearance, special status plant species clearance, etc.).

   The above plans may be prepared by the Operators for the project area or submitted incrementally with each APD, ROW application, or Sundry Notice.

2. The BLM would conduct environmental reviews for each APD, ROW application, or Sundry Notice to identify final well or facility locations, access road alignments, and pipeline routes. Where practical, on-site visits would occur before Operator surveying. This will, through early identification of significant issues, minimize revisions and reduce or eliminate the need for additional site visits.

3. Approval of individual project components (i.e., wells, roads, pipelines, and ancillary facilities) would be contingent on completion and acceptance of a site-specific cultural resource literature search, Class III inventory report, and, as necessary, paleontological inventory; T&E, candidate, and sensitive species surveys; sage grouse lek clearance; raptor nest clearance; and any other clearance specified by the Authorized Officer (AO).

4. Operators would include in APD, ROW, or other appropriate permit applications, discussion of site-specific mitigation and environmental protection measures and a map showing specific locations where these measures would be implemented. Final locations for these measures would be confirmed by BLM and the Operators following on-site inspections of project locations.

2.4.11.2 Air Quality

1. Regular equipment maintenance, including emissions checks, and regular maintenance of roads would be conducted as necessary throughout the LOP.

2. Operators would water construction sites as necessary to control fugitive dust.

3. No open burning of garbage or refuse would be allowed at the well sites or other facilities. Any open burning would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations (WDEQ 1989).

4. Necessary air quality permits to construct, test, and operate facilities would be obtained from the WDEQ-AQD. All internal combustion equipment would be kept in good working order.

5. Operators would adhere to State of Wyoming-imposed regional NO_x or other air pollutant emission limits (i.e., levels of concern [BLM 1997a]) unless otherwise modified, as well as applicable Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS).

2.4.11.3 Topography and Physiography

1. Operators would incorporate in their Surface Use Plans and Plans of Development the procedures contained in *Standard Practices Applied to Surface-Disturbing Activities* (BLM 1992b:Appendix 7-2), guidelines for road construction contained in BLM Manual, Section 9113 (BLM 1985, 1991a) and the project transportation and reclamation plans (see Appendices A and B).

2. Unnecessary topographic alterations would be mitigated by avoiding, where possible, steep slopes, rugged topography, and perennial and ephemeral/intermittent drainages, and by minimizing the area disturbed.

3. Upon completion of construction and/or production activities, operators would restore the topography to near pre-existing contours at well sites, access roads, pipelines, and other facility sites.

2.4.11.4 Geological/Paleontological Resources

1. Wells, pipelines, and ancillary facilities would be designed and constructed such that they would not be damaged by moderate earthquakes. Any facilities defined as critical according to the Uniform Building Code would be constructed in accordance with applicable Uniform Building Code Standards for Seismic Risk Zone 2B.

2. In areas of paleontological sensitivity, a determination would be made by the BLM as to whether a survey by a qualified paleontologist is necessary prior to the disturbance. In some cases, construction monitoring, project relocation, data recovery, or other mitigation would be required to ensure that significant paleontological resources are avoided or recovered during construction.

3. If paleontological resources are uncovered during surface-disturbing activities, Operators would suspend all operations that would further disturb such materials and immediately contact the AO, who would arrange for a determination of significance, and, if necessary, recommend a recovery or avoidance plan. Mitigation of impacts to paleontological resources would be on a case-by-case basis, and Operators would either avoid or protect paleontological resources.

2.4.11.5 Soils

1. Operators would adhere to the reclamation guidelines presented in Appendix B. Adverse impacts to soils would be mitigated by minimizing disturbance; avoiding construction with frozen soil materials; avoiding areas with high erosion potential (e.g., unstable soil, dunal areas, slopes greater than 25%, floodplains), where possible; salvaging and selectively handling topsoil from disturbed areas; adequately protecting stockpiled topsoil and replacing it on the surface during reclamation; leaving the soil intact (scalping only) during pipeline construction, where possible; using appropriate erosion and sedimentation control techniques including, but not limited to, diversion terraces, riprap, and matting; and promptly revegetating disturbed areas using adapted species. Temporary erosion control measures such as temporary vegetation cover; application of mulch, netting, or soil stabilizers; and/or construction of barriers may be used in some areas to minimize wind and water erosion and sedimentation prior to vegetation establishment. Specific measures and locations would be specified in Surface Use Plans or Plans of Development prepared during the APD and/or ROW application processes.

2. Pipeline ROWs would be located to minimize soil disturbance. Mitigation would include locating ROWs adjacent to access roads to minimize ROW disturbance widths, or routing pipeline ROWs directly to minimize disturbance lengths.

3. Appropriate erosion control and revegetation measures would be employed (see Appendix B).

Grading and landscaping would be used to minimize slopes, and water bars would be installed on disturbed slopes in areas with unstable soils where seeding alone may not adequately control erosion. Erosion control efforts would be monitored by the BLM and Operators and augmented, as necessary, to control erosion.

4. Sufficient topsoil or other suitable material to facilitate revegetation would be segregated from subsoils during all construction operations requiring excavation and would be returned to the surface upon completion of operations. Soils compacted during construction would be ripped and tilled as necessary prior to reseeding. Cut and fill sections on all roads and along pipelines would be revegetated with native species.

5. Operators would revegetate all disturbed sites as soon as practical following disturbance (see Appendix B).

6. Any accidental soil contamination by spills of petroleum products or other hazardous materials would be cleaned up and the soil disposed of or rehabilitated as specified in the Operators' SPCCP.

7. Operators would restrict off-road vehicle (ORV) activity by employees and contract workers.

8. Project-related travel would be limited to only that necessary for efficient project operation during periods when soils are saturated and excessive rutting could occur.

9. To prevent reactivation of stabilized dunes, these areas would be avoided where possible, and areas necessarily disturbed would be seeded in the first appropriate season after disturbance. If deemed appropriate by the BLM AO, disturbed areas would be mulched or otherwise protected to prevent wind erosion and facilitate plant establishment.

2.4.11.6 Water Resources

1. Operators would avoid disturbance within 500 ft of wetlands/riparian areas and open water areas and within 100 ft of ephemeral/intermittent drainages, where possible. If streams would be crossed by roads, culverts would be installed at all appropriate locations as specified in the BLM Manual 9112-Bridges and Major Culverts (BLM 1990a) and Manual 9113-Roads (BLM 1985). Streams would be crossed perpendicular to flow, where possible, and all stream crossing structures would be designed to carry the 25-year discharge event or other capacities as directed by the BLM.

2. All water used in association with this project would be obtained from Wyoming State Engineer's Office (WSEO)-approved groundwater wells.

3. Guidelines specified in the Operators' SPCCPs would be adhered to such that any spill or accidental discharge of hazardous material would be remediated. An orientation would be conducted by the Operators to ensure that project personnel are aware of the potential impacts that can result from accidental spills and that they know the appropriate recourse if a spill occurs. Streams at pipeline crossings would be protected from contamination by pipeline breaks with shutoff valves or other systems capable of minimizing accidental discharge.

4. Erosion-prone (e.g., drainages) or high-salinity areas would be avoided where possible, and necessary construction in these areas would be done in the late summer, fall, and winter (prior to soil freezing) to avoid runoff periods. Proper containment of oil and produced water in tanks, drilling fluids in reserve pits, and the location of staging areas for storage of equipment away from drainages would prevent potential contaminants from entering surface waters.

5. Prudent use of erosion control measures, including diversion terraces, riprap, matting, temporary sediment traps, and water bars would be employed as necessary. Interceptor dikes would be used to control surface runoff generated at well locations, and dike location and construction methods would be described in APD and ROW plans. If necessary to reduce suspended sediment loads and remove potential contaminants, Operators would treat diverted water in detention ponds prior to release to meet applicable state or federal standards. If water is discharged into an established drainage channel, the rate of discharge would not exceed the

capacity of the channel to convey the increased flow. Waters that do not meet applicable state or federal standards would be evaporated, treated, or disposed of at an approved disposal facility.

6. Operators would construct reserve pits with 2 ft of freeboard in cut areas or in compacted and stabilized fill. Subsoil material stability and permeability in the area of construction would be evaluated and the need for pit reinforcement assessed. The subsoil material at proposed pit locations would be inspected to assess soil stability and permeability and whether reinforcement and/or lining are required. Prior to installation of reserve pit liners and/or fluids, reserve pits would be inspected by BLM personnel. Earthen reserve pits would be used only after evaluation of the pit location for distance to surface waters, depth to useable groundwater, and soil type and permeability, and after evaluation of the fluids which would likely be retained in the pit.

7. If reserve pit leakage is detected, operations at the site would be curtailed, as directed by the BLM, until the leakage is corrected.

8. All wells would be cased and cemented to protect subsurface mineral and freshwater zones. Unproductive wells and wells that have completed their intended purpose would be properly abandoned and plugged using procedures identified by the Office of State Oil and Gas Supervisor, Rules and Regulations of WOGCC and the BLM.

9. Channel crossings by pipelines would be constructed so that the pipe is buried at least 4 ft below the channel bottom.

10. Channel crossings by roads and pipelines would be constructed perpendicular to flow.

11. Disturbed channel beds would be reshaped to their approximate original configuration.

12. The disposal of all water (hydrostatic test water, stormwater, produced water) would be done in conformance with WDEQ-Water Quality Division (WQD) (WDEQ 1990a), BLM Onshore Oil and Gas Order No. 7, and WOGCC (WOGCC 1992) rules and regulations.

13. Operators would prepare SWPPPs for all disturbances greater than 5 acres in size as required by WDEQ National Pollution Discharge Elimination System (NPDES) permit requirements. In some instances, SWPPPs for groups of wells would be developed.

14. Operators would implement SPCCPs if liquid petroleum products or other hazardous materials are stored on-site in sufficient quantities, in accordance with 40 CFR 112.

15. Any disturbances to wetlands and/or waters of the U.S. would be coordinated with the COE, and 404 permits would be secured as necessary prior to disturbance.

16. To mitigate potential impacts caused by flooding during the LOP, construction in flood-prone areas would be limited to late summer, fall, or winter when conditions are generally dry and streamflows are low or non-existent. Additional mitigation to lessen any impacts from flooding or high flows during and after construction would include the avoidance of areas with high erosion potential (i.e., steep slopes, floodplains, unstable soils); reestablishment of existing contours where possible; avoidance of areas within 500 ft of wetland edges, riparian areas, and open water, where possible; avoidance of areas within 100 ft of ephemeral drainages, where possible; and implementation of appropriate erosion and sediment control and revegetation procedures.

2.4.11.7 Noise

Noise mitigation would be applied at well locations, as determined necessary on a case-by-case basis by the BLM. All engines required for project activities would be properly muffled and maintained. Construction, drilling, completion, testing, and production facility installation activities would be seasonally restricted proximal to active raptor nests during the nesting period and in sage grouse breeding and nesting areas. Road use and travel pattern specifications designed, in part, to keep traffic to a minimum and to reduce noise impacts would be identified in the Transportation Plan (see Appendix A).

2.4.11.8 Vegetation

1. Operators would finance site-specific surveys for special status plant species (SSPS) prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI-BLM 6840). These surveys would be completed by a qualified botanist as authorized by the BLM and this botanist would be subject to BLM's SSPS survey policy requirements. Data from these surveys would be provided to the BLM, and if any SSPS or habitats are found, BLM recommendations for avoidance or mitigation would be implemented.

2. Herbicide applications would be kept at least 500 ft from known SSPS populations or other distance deemed safe by the AO.

3. Removal and disturbance of vegetation would be kept to a minimum through construction site management (e.g., using previously disturbed areas and existing easements, limiting equipment/materials storage yard and staging area size, etc.). Well locations and associated roads and pipelines would be located to avoid or minimize impacts in areas of high value (e.g., SSPS habitats, wetland/riparian areas).

4. Proper erosion and sediment control structures and techniques would be incorporated by the Operators into the design of well pads, roads, pipelines, and other facilities. Revegetation using a BLM-approved, locally adapted seed mixture containing native grasses, forbs, and shrubs would begin in the first appropriate season following disturbance. Vegetation removed would be replaced with plants of equal forage value and growth form using procedures that include:
   - fall reseeding (September 15 to freeze-up), where feasible;
   - spring reseeding (prior to April 15) if fall seeding is not feasible;
   - deep ripping of compacted soils prior to reseeding;
   - surface pitting/roughening prior to reseeding;
   - utilization of native cool season grasses, forbs, and shrubs in the seed mix;
   - interseeding of shrubs into an established stand of grasses and forbs at least one year after seeding the grasses and forbs;
   - appropriate, approved weed control techniques;
   - broadcast or drill seeding, depending on site conditions; and
   - fencing of certain sensitive reclamation sites (e.g., riparian areas, steep slopes, and areas within 0.5 mi of livestock watering facilities) as determined necessary through monitoring.

5. Recontouring and seedbed preparation would occur immediately prior to reseeding on the unused portion of well locations and road ROWs and entire pipeline ROWs outside of road ROWs. In the event of uneconomical wells, Operators would initiate reclamation of the entire well location, access road, and adjacent disturbed habitat as soon as possible. Reclamation would be monitored by the Operators and the BLM, as specified in the Reclamation Plan (Appendix B), to determine and ensure successful establishment of vegetation.

6. Operators would monitor noxious weed occurrence on the project area and implement a noxious weed control program in cooperation with the BLM and Sublette County to ensure noxious weed invasion does not become a problem. Weed-free certification by county extension agents would be required for grain or straw used for mulching revegetated areas. Gravel and other surfacing materials used for the project would be free of noxious weeds.

7. Operators would evaluate all project facility sites for occurrence of waters of the U.S., special aquatic sites, and wetlands, per COE requirements. All project activities would be located outside of these sensitive areas, where practical.

8. Where wetlands, riparian areas, streams, and ephemeral/intermittent stream channels must be disturbed, COE Section 404 permits would be obtained as necessary, and the following measures would be employed:
   - Wetland areas would be crossed during dry conditions (i.e., late summer, fall, or dry winters); winter construction activities would occur only prior to soil freezing or after soils have thawed.
   - Streambeds would be crossed perpendicular to flow.

- Streams, wetlands, and riparian areas disturbed during project construction would be restored to as near pre-project conditions as practical, and if impermeable soils contributed to wetland formation, soils would be compacted to reestablish impermeability.
- Wetland topsoil would be selectively handled.
- Areas would be recontoured and BLM-approved species would be used for reclamation.
- Reclamation activities would begin on disturbed wetland areas immediately after completion of project activities.

2.4.11.9 Wildlife and Fisheries

1. The Operators, in consultation with representatives from BLM, WGFD, USFWS, and other interested groups such as area livestock operators, would adhere to the Wildlife Monitoring/Protection Plan for this project (see Appendix D). The plan would be incorporated into the Operators' field operations manual or handbook, a copy of which would be kept on-site and in the BLM PRA, GRRA, and Rock Springs District Offices.

2. To minimize wildlife mortality due to vehicle collisions, Operators would advise project personnel regarding appropriate speed limits in the project area, and roads would be reclaimed as soon as possible after they are no longer required. Some existing roads in the project area may be closed and reclaimed by the Operator as directed by the BLM. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by the Operators, and/or prosecuted by the WGFD.

3. Operators would comply with the following guidelines for avoidance of raptor nests and sage grouse leks and nesting areas:

   Raptors
   - Well locations, pipelines, and associated roads would be selected and designed to avoid disturbances to areas of high wildlife value (e.g., raptor nest sites, wetland areas).
   - Raptor nest surveys would be conducted within a 0.5- to 1.0-mi radius of proposed surface use or activity areas if such activities are proposed to be conducted between February 1 and July 31.
   - All surface-disturbing activity (e.g., road, pipeline, well pad construction, drilling, completion, workover operations) would be seasonally restricted from February 1 through July 31 within a 0.5-mi radius of all active raptor nests, except ferruginous hawk nests, for which the seasonal buffer would be 1.0 mi. (An active raptor nest is defined as a nest that has been occupied within the past 3 years.) The seasonal buffer distance and exclusion dates applicable may vary depending on such factors as the activity status of the nest, species involved, prey availability, natural topographic barriers, line-of-site distance(s), and other conflicting issues such as cultural values, steep slopes, etc.
   - Well locations, roads, ancillary facilities, and other surface structures requiring repeated human presence would not be constructed within 825 ft (2,000 ft for bald eagles) of active raptor nests, where practical.

   Sage grouse
   - Surface disturbance within 0.25 mi of a sage grouse lek would be avoided.
   - Permanent, high profile structures such as buildings and storage tanks would not be constructed within 0.25 mi of a lek.
   - Operators would restrict construction activities between March 1 and June 30 within a 2.0-mi radius of active sage grouse leks on suitable sage grouse nesting habitat as determined during on-site reviews of proposed development areas.
   - If an active sage grouse nest is identified in an area proposed for disturbance, surface-disturbing activities would be delayed in the area until nesting is completed.
   - Field evaluations for sage grouse leks would be conducted by a qualified biologist prior to

the start of activities in potential sage grouse habitat. These field evaluations for leks would be conducted if project activities are planned in potential sage grouse habitat between February 1 and July 31. BLM wildlife biologists would ensure that such surveys are conducted using proper survey methods.

4. Wildlife-proof fencing would be utilized on reclaimed areas if it is determined that wildlife species are impeding successful vegetation establishment.

5. ROW fencing associated with this project would be kept to a minimum and, if necessary, fences would consist of four-strand barbed wire meeting WGFD approval for facilitating wildlife movement.

6. Reserve, workover, and production pits potentially hazardous to wildlife would be adequately protected (e.g., fencing, netting) to prohibit wildlife access as directed by the BLM.

7. USFWS and WGFD consultation and coordination would be conducted for all mitigation activities relating to raptors and T&E species and their habitats, and all permits required for movement, removal, and/or establishment of raptor nests would be obtained.

8. Operators would implement policies designed to control poaching and littering and would notify all employees (contract and company) that conviction of a major game violation could result in disciplinary action. Contractors would be informed that any intentional poaching or littering within the project area could result in dismissal.

9. Firearms and dogs would not be allowed on-site during working hours. Operators have existing drug, alcohol, and firearms policies that would be internally enforced.

10. Surveys for T&E and candidate wildlife species would be implemented in areas of potential habitat by a qualified biologist prior to disturbance. Findings would be reviewed by the BLM prior to or as components of ROW applications and APD review processes. If T&E and/or candidate species are found in the area, consultation with the USFWS would be initiated, and construction activities would be curtailed until there is concurrence between BLM, USFWS, and the Operator on what activities can be authorized.

11. Operators would adhere to all survey, mitigation, and monitoring requirements identified in the Biological Assessment (BA) for this project (Appendix E).

12. No surface water or shallow groundwater in connection with surface water would be utilized for the proposed project.

13. Mountain plover surveys would be conducted within suitable plover habitat on the J2PA by a qualified biologist in accordance with USFWS guidelines. The survey procedures would include the following:
    - Visual observation of the area within 0.25 mi of proposed well locations and 300 ft of proposed access routes would be made to detect the presence of plovers. All plovers located would be observed long enough to determine if a nest is present.
    - Surveys would be conducted no more than 14 days prior to the date actual ground-disturbance activities begin. If two surveys are required, they would be made at least 14 days apart, with the last survey no more than 14 days prior to the start-up date.
    - The number of surveys required to clear a site for mountain plovers prior to beginning a planned activity depends on the start-up date, as shown below:

Date of Planned Activity	# Surveys Required
March 15 - April 15	1
April 15 - July 15	2
July 15 - August 15	1

    - If an active plover nest is found in the survey area, the planned activity would be delayed at least 30 days. If a brood is observed, activities would be delayed at least seven days.

14. Proposed construction sites not examined for prairie dogs during past surveys would be examined prior to surface-disturbing activities to

confirm the presence or absence of prairie dog colonies. Confirmation would be made of white-tailed prairie dog colony/complex size, burrow density, and any other data indicating whether the criteria established in the USFWS (1989a) guidelines for black-footed ferret habitat are met. If prairie dog colonies are found, a qualified biologist would locate all project components to avoid direct impacts to the colony. If this is not practical, black-footed ferret surveys of prairie dog colonies, where required by the USFWS, would be conducted in accordance with USFWS guidelines and requirements. This information would be provided to the USFWS in accordance with Section 7 of the ESA, as amended, and the Interagency Cooperation Regulations.

15. If nests of loggerhead shrike are found within 0.5 mi of a well pad or access road during on-site inspection or during other clearance surveys, avoidance of the nest site would be accomplished in consultation and coordination with the USFWS and BLM.

2.4.11.10 Livestock/Grazing Management

1. Reclamation of nonessential areas disturbed during construction activities would be accomplished in the first appropriate season after well completion. Nonessential areas include portions of the well locations not needed for production operations, the borrow ditch and outslope portions of new road ROWs, entire pipeline ROWs outside of road ROWs, and all roads and associated disturbed areas at nonproductive well locations. Operators would repair or replace fences, cattleguards, gates, drift fences, and natural barriers to maintain current BLM standards. Cattleguards would be used instead of gates for livestock control on most road ROWs. Livestock would be protected from pipeline trenches, and livestock access to existing water sources would be maintained.

2. The BLM, Operators, and livestock permittees would monitor livestock movements, especially regarding any impacts from roads or disturbance from construction and drilling activities. Appropriate measures would be taken to correct any adverse impacts, should they occur.

2.4.11.11 Cultural Resources

1. Operators would follow the Section 106 compliance process prior to any surface-disturbing activity and would either avoid or protect cultural resource properties.

2. Operators would halt construction activities if previously undetected cultural resource properties are discovered during construction. The BLM would be notified immediately, and consultation with the Wyoming State Historic Preservation Office (SHPO) and Advisory Council would be initiated to determine proper mitigation measures pursuant to 36 CFR 800.11 or other treatment plans, programmatic agreements, or discovery plans that may direct such efforts. Construction would not resume until a Notice to Proceed is issued by the BLM.

3. If areas of religious importance, traditional cultural properties, or other sensitive Native American areas are identified in affected areas, BLM, affected tribes, and the Operators would identify potential impacts and determine appropriate mitigative treatments on a case-by-case basis.

2.4.11.12 Socioeconomics

1. Operators would encourage the use of local or regional workers.

2. Operators would schedule concentrations of project traffic, such as truck convoys or heavy traffic flows, to avoid periods of expected heavy traffic flows associated with recreation. Travel and parking would be restricted to access roads and on-site parking areas.

2.4.11.13 Land Status/Use/Prior Rights

1. Mitigation to prior rights would include:
   - limiting drilling operations to lands leased or owned by the Operators;
   - locating wells away from known underground cables;
   - regrading and repairing roads, as necessary, in areas damaged by project activities;
   - reestablishing a level, compacted surface where pipelines cross existing roads;

- advance identification and flagging of all existing ROWs that will be crossed by proposed pipelines and roads;
- backhoe and hand excavation at pipeline crossings until the exact locations of existing underground lines have been determined; and
- restoring native vegetation as soon as practical.

2. Roads and pipelines would be located adjacent to existing linear facilities wherever practical.

2.4.11.14 Recreation

1. Operators would post appropriate warning signs and require project vehicles to adhere to appropriate speed limits on project-required roads.

2. Operators would inform their employees, contractors, and subcontractors that long-term camping (greater than 14 days) on federal lands or at federal recreation sites is prohibited.

3. Operators would direct their employees, contractors, and subcontractors to abide by all state and federal laws and regulations regarding hunting.

2.4.11.15 Visual Resources

1. Operators would utilize existing topography to screen roads, pipeline corridors, drill rigs, wells, and production facilities from view, where practical.

2. Operators would paint all aboveground production facilities with appropriate colors (e.g., Carlsbad Canyon) to blend with adjacent terrain, except for structures that require safety coloration in accordance with OSHA requirements.

2.4.11.16 Transportation

1. Detailed practices and procedures as specified in the Transportation Plan for this project would be followed (Appendix A). Annual transportation plans would be developed and would identify the minimum road network required to support annually proposed project activities, as well as construction and maintenance responsibilities of the Operators. Annual plans also would identify road-specific dust abatement, road construction, and surfacing requirements.

2. Existing roads would be used to the maximum extent possible and upgraded as necessary.

3. All roads not required for routine operation and maintenance of producing wells or ancillary facilities would be reclaimed as directed by the BLM, State Land Board, or private landowner. These roads would be permanently blocked, recontoured, reclaimed, and revegetated by the Operators, as would disturbed areas associated with permanently plugged and abandoned wells.

4. Site-specific centerline survey and construction designs would be submitted to and approved by the BLM prior to road construction.

5. Operators would comply with existing federal, state, and county requirements and restrictions to protect road networks and the traveling public.

6. Special arrangements would be made with the WDOT to transport oversize loads to the project area. Otherwise, load limits would be observed at all times to prevent damage to existing road surfaces.

7. All development activities along approved ROWs would be restricted to areas authorized in the approved ROW.

8. Available topsoil would be stripped from all road corridors prior to commencement of construction activities and would be redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction activities. Borrow ditches would be reseeded in the first appropriate season after initial disturbance.

2.4.11.17 Health and Safety/Hazardous Materials

1. Operators would utilize WDEQ-approved portable sanitation facilities at drill sites.

2. Operators would place warning signs near hazardous areas and along roadways.

3. Operators would place dumpsters at each construction site to collect and store garbage and refuse.

4. Operators would ensure that all refuse and garbage is transported to a State-approved sanitary landfill for disposal.

5. Operators would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA (29 CFR 1910.1200).

6. In accordance with 29 CFR 1910.1200, a Material Safety Data Sheet for every chemical or hazardous material brought on-site would be kept on file at the Operator's field office.

7. SPCCPs would be written and implemented in accordance with 40 CFR 112.

8. Chemical and hazardous materials would be inventoried and reported in accordance with the SARA Title III (40 CFR 335). If quantities exceeding 10,000 pounds or the threshold planning quantity are to be produced or stored, the appropriate Section 311 and 312 forms would be submitted at the required times to the State and County Emergency Management Coordinators and the local fire departments.

9. Any hazardous wastes, as defined by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.

10. Operators would adhere to existing internal health and safety policies and procedures (MOC 1992; SOCO 1992, n.d.; Amoco 1993, 1995; WGR n.d.).

2.5 THE NO ACTION ALTERNATIVE

CEQ regulations for implementing NEPA require that a "No Action" alternative be considered in all EISs, "even if the agency is under a court order or legislative command to act. This analysis provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives. This No Action Alternative is also an example of a reasonable alternative outside the jurisdiction of the agency which must be analyzed" (46 CFR 18026, March 23, 1981). Under the No Action Alternative, the BLM would deny further natural gas development on federal lands in the J2PA as currently proposed by the Operators, while allowing existing land uses to continue. The decision to select the No Action Alternative for this project is available to the BLM through denial of individual APDs; however, the right to drill and develop somewhere within the leasehold cannot be denied by the Secretary of the Interior because valid leases have been issued which specifically grant the lessee (or his designated operator) the *"right to drill for ... extract, remove and dispose of all oil and gas deposits"* from the leased lands subject to the terms and conditions of the respective leases.

For the purposes of analysis in this EIS, the No Action Alternative would mean that the Proposed Action and other action alternatives would not be implemented and that existing land uses would continue in the J2PA. This land use would include completion of the already approved Jonah Prospect Field (BLM 1994b). The DR for the Jonah Prospect Field approved the drilling of 40 wells, with approximately 24 mi of new access road, approximately 24 mi of gathering pipeline, construction of 2 sales pipelines (27.8 mi total length), and a wareyard and compressor station expansion. There are no other developments proposed for the area at this time, nor are any anticipated in the reasonably foreseeable future, although it is acknowledged that, given the natural gas reserves apparently available within the J2PA, proposals to recover those resources are likely to be developed sometime in the future. If and when proposals are formalized, they would be subjected to analysis under NEPA.

2.6 ALTERNATIVES CONSIDERED BUT REJECTED

An alternative that included a well location density of 16 wells/section (40-acre spacing) was considered but rejected, since the current understanding of gas reservoir characteristics on and adjacent to the J2PA do not yet indicate the need for 40-acre spacing and analyzing a 40-acre spacing scenario would overestimate anticipated environmental impacts. If a 40-acre spacing is deemed appropriate in the future, additional NEPA analyses would be required (e.g., a supplemental EIS).

A phased development alternative was considered and rejected, since the Proposed Action, as presented by Operators, involves the incremental development of the J2PA. Wells would be developed as the extent of

natural gas reservoirs is defined and infill drilling would occur, as necessary, to ensure that gas production procedes in the most efficient manner. In addition, an alternative mandating the use of directional drilling was also considered but rejected since all alternatives considered in this EIS may involve the use of directional drilling to access natural gas reserves beneath areas with sensitive surface resources.

Alternatives involving fewer wells and associated facilities on the J2PA were also considered. These alternatives were rejected because the extent of development necessary to recover existing natural gas resources on the project area is presently unknown. Therefore, limiting the number of wells could result in the by-pass of federal mineral resources and/or the necessity for future NEPA analyses.

2.7 SUMMARY OF ENVIRONMENTAL IMPACTS

A summary of impacts from the Proposed Action and alternatives is provided in Table 2.7. A detailed analysis of project impacts and mitigation measures is presented Chapter 4.0.

Table 2.7 Summary Comparison of Impacts, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	**Alternative A**	**Alternative B**
	AIR QUALITY		
Increased criteria and hazardous air pollutant emissions	Increases in dust and emissions adjacent to well locations, roads, and ancillary facilities (life-of-project[1] [LOP]); approximately 12 $\mu g/m^3$ nitrogen dioxide (NO_2), 21 $\mu g/m^3$ particulates $\leq$ 10 microns (PM_{10}) annually, 30 $\mu g/m^3$ ozone, and 22.3 tons/year hazardous air pollutants (HAPs)	Same as Proposed Action but reduced by an unquantified amount	Same as Proposed Action but reduced by an unquantified amount
Air Quality Related Values (AQRV)	Increased potential visibility impairment and acid deposition in regional Class I airsheds; potential maximum of 1 day/year with visibility reduced by 1.0 deciviews, and 11 days/year with visibility reduced by 0.5 deciviews, LOP	Same as Proposed Action but reduced by an unquantified amount	Same as Proposed Action but reduced by an unquantified amount
	GEOLOGIC HAZARDS		
Earthquake damage to pipelines and facilities	LOP - Low earthquake potential	Similar to Proposed Action	Similar to Proposed Action
Landslides and slumping at construction sites	LOP - no known landslide areas or underground mines in the Jonah Field II project area (J2PA), the depth of gas reserves negates the potential for subsidence	Similar to Proposed Action	Similar to Proposed Action
	PALEONTOLOGICAL RESOURCES		
Disturbance/destruction of important fossils	During construction - minimal disturbance of bedrock; a maximum of 3,250 acres of surface disturbance	Reduced from Proposed Action (i.e., a maximum of 3,073 acres of surface disturbance)	Reduced from Proposed Action (i.e., a maximum of 2,585 acres of surface disturbance)
Loss of important fossil materials due to private collection or vandalism	LOP - minimal disturbance of bedrock; a maximum of 3,250 acres of surface disturbance	Reduced from Proposed Action (i.e., a maximum of 3,073 acres of surface disturbance)	Reduced from Proposed Action (i.e., a maximum of 2,585 acres of surface disturbance)
Discovery of previously unknown fossils	During construction - minimal disturbance of bedrock; a maximum of 3,250 acres of surface disturbance	Reduced from Proposed Action (i.e., a maximum of 3,073 acres of surface disturbance)	Reduced from Proposed Action (i.e., a maximum of 2,585 acres of surface disturbance)

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts: Proposed Action	Alternative A	Alternative B
MINERALS/GAS AND OIL			
Depletion of gas and condensate reserves	Permanent - maximum extraction of reserves; recovery of approximately 617,610 million cubic feet (mmcf) natural gas and 4,940 million barrels (bbl) of condensate during the first 10 years of the project	Similar to Proposed Action, but may result in failure to recover some natural gas reserves, either completely, or in an economical fashion	Similar to Proposed Action, but may result in failure to recover some natural gas reserves, either completely, or in an economical fashion
Incomplete recovery of available natural gas reserves	Maximum extraction of reserves	May result in failure to recover some natural gas reserves, either completely, or in an economical fashion	May result in failure to recover some natural gas reserves, either completely, or in an economical fashion
Potential temporary loss (locally) of access to other mineral resources	LOP - other minerals are not available in minable quantities using current technology	Similar to Proposed Action, but reduced by approximately 6%	Similar to Proposed Action, but reduced by 21-23%
SOILS			
Disturbance and erosional loss of soils	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - a maximum of 2,585 acres of surface disturbance would occur (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Soil compaction and mixing of soil horizons; decreased topsoil productivity	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 2,585 acres (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Contamination due to accidental hazardous material discharge	LOP - adherence to spill prevention and control countermeasure plans (SPCCPs) and other applicable local, state, and federal rules and regulations would minimize this potential impact	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
Reactivation of stabilized dunes due to ground cover removal and inadequate reclamation	LOP and until adequate reclamation is achieved - less than 22 and 11 acres of short-term and LOP surface disturbance, respectively, in dunal areas	Reduced from the Proposed Action (i.e., less than 20 and 10 acres of short-term and LOP surface disturbance, respectively, in dunal areas)	Reduced from Proposed Action (i.e., less than 17 and 9 acres of short-term and LOP surface disturbance, respectively, in dunal areas)
SURFACE WATER RESOURCES			
Increased turbidity, salinity, and sedimentation of surface waters due to runoff from disturbed areas	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 2,585 acres (1,709 and 876 acres of short-term and LOP disturbance, respectively)

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	Alternative A	Alternative B
SURFACE WATER RESOURCES (Continued)			
Contamination of surface waters from accidental hazardous material spills	LOP - impacts would be minimized by implementation of applicant-committed practices	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
Contamination of surface waters from discharge of unsuitable quality produced water and/or pipeline test water	LOP - impacts would be minimized by implementation of applicant-committed practices	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
Alteration of surface drainages	LOP - no long-term modifications to drainages	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
Flood damage to pipelines and facilities	LOP - flood-prone areas in the J2PA are limited and would be avoided where possible	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
GROUNDWATER RESOURCES			
Reduced groundwater availability from withdrawal of drilling water	LOP and until aquifers recharge - a maximum of 450 gas well locations would be drilled	Similar to the Proposed Action, but the number of well locations would be reduced by 30	Similar to the Proposed Action, but the number of well locations would be reduced by 123
Contamination of groundwater from discharge of produced water, accidental hazardous material spills, and/or cross-aquifer mixing through well bores	LOP and until aquifers recharge - a maximum of 450 gas well locations would be drilled	Similar to the Proposed Action, but the number of well locations would be reduced by 30	Similar to the Proposed Action, but the number of well locations would be reduced by 123
NOISE			
Increased noise levels in the J2PA during construction and for the LOP	During construction - temporary noise levels of up to 115 A-weighted decibels (dBA) at the source; LOP - increased noise levels from compression and traffic	Similar to the Proposed Action, but well locations reduced by 30; noise-sensitive locations (i.e., active raptor nests and sage grouse leks) would be further protected by Conditional Surface Use (CSU) restrictions	Similar to the Proposed Action, but well locations would be reduced by 123
ODOR			
Presence of offensive odors proximal to facilities and roads	LOP - temporary, localized, and would be dispersed by the wind	LOP - temporary, localized, and would be dispersed by the wind	LOP - temporary, localized, and would be dispersed by the wind

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	Alternative A	Alternative B
		VEGETATION	
Removal of vegetation	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 2,585 acres (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Changes in vegetation diversity following reclamation (i.e., shrubland to grassland) and potential weed infestation	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 2,585 acres (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Disturbance of wetlands	LOP - no net loss of wetlands	Same as Proposed Action	Same as Proposed Action
Reclamation unsuccessful after five years	LOP and beyond - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP and beyond - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP and beyond - maximum surface disturbance of 2,585 acres (1,709 and 876 acres of short-term and LOP disturbance, respectively)
		WILDLIFE	
Loss of pronghorn habitat	A maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP surface disturbance, respectively) would occur, all of which would be spring/summer/fall pronghorn habitat (i.e., approximately 0.1% of this type habitat in the Sublette Herd Unit)	A maximum of 3,073 acres of surface disturbance would occur in pronghorn spring/summer/fall habitat (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	A maximum of 2,585 acres of surface disturbance would occur in pronghorn spring/summer/fall habitat (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Loss of sage grouse productivity	Maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP surface disturbance, respectively); 0.25-mi and 2.00-mi radius buffer zones would be implemented around leks and breeding grounds, respectively, during breeding season	Similar to the Proposed Action, but reduced to a maximum of 3,073 acres of surface disturbance (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	Similar to the Proposed Action, but reduced to a maximum of 2,585 acres of surface disturbance (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Loss of raptor productivity	Maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP surface disturbance, respectively)	Similar to the Proposed Action, but reduced to a maximum of 3,073 acres of surface disturbance (2,043 and 1,030 acres of short-term and LOP disturbance, respectively); a 0.5-mi radius buffer zone around active raptor nests would be implemented	Similar to the Proposed Action, but reduced to a maximum of 2,585 acres of surface disturbance (1,709 and 876 acres of short-term and LOP disturbance, respectively)

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	**Alternative A**	**Alternative B**
WILDLIFE (Continued)			
Animal displacement and/or stress	Maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP surface disturbance, respectively); increased human activity would decrease the amount of habitat available for some species	Similar to the Proposed Action, but reduced to a maximum of 3,073 acres of surface disturbance (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	Similar to the Proposed Action, but reduced to a maximum of 2,585 acres of surface disturbance (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Increased wildlife mortality from project-related activities	A maximum of 450 well locations would be drilled	Similar to the Proposed Action, but the number of well locations would be reduced by 30	Similar to the Proposed Action, but the number of well locations would be reduced by 123
Overall wildlife habitat degradation	Maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP surface disturbance, respectively)	Similar to the Proposed Action, but reduced to a maximum of 3,073 acres of surface disturbance (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	Similar to the Proposed Action, but reduced to a maximum of 2,585 acres of surface disturbance (1,709 and 876 acres of short-term and LOP disturbance, respectively)
THREATENED, ENDANGERED, AND SENSITIVE SPECIES			
Mortality or disturbance of any listed or candidate threatened or endangered (T&E) species or disturbance of critical habitat for listed and candidate T&E species	LOP - maximum surface disturbance of 3,250 acres; there are no known bald eagle or peregrine falcon nests or roosts, no confirmed black-footed ferret sightings, mountain plover searches would be implemented, and there would be no surface water withdrawal	Similar to the Proposed Action, but a maximum of 3,073 acres will be disturbed	Similar to the Proposed Action, but a maximum of 2,585 acres will be disturbed
Reductions in other sensitive species and/or species of concern due to mortality or habitat removal	LOP - maximum surface disturbance of 3,250 acres	Similar to the Proposed Action, but a maximum of 3,073 acres will be disturbed	Similar to the Proposed Action, but a maximum of 2,585 acres will be disturbed
WILD HORSES			
Wild horse displacement or mortality due to habitat destruction or other project-related activities	LOP - approximately 260 acres (0.0005%) of the 519,541-acre Colorado Desert Interim Wild Horse Herd Management Area would be disturbed	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	**Alternative A**	**Alternative B**
	CULTURAL RESOURCES		
Disturbance/destruction of important sites	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - a maximum of 2,585 acres of surface disturbance would occur (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Loss of important cultural materials due to private collection or vandalism	LOP - maximum surface disturbance of 3,250 acres (2,164 and 1,086 acres of short-term and LOP disturbance, respectively)	LOP - maximum surface disturbance of 3,073 acres (2,043 and 1,030 acres of short-term and LOP disturbance, respectively)	LOP - a maximum of 2,585 acres of surface disturbance would occur (1,709 and 876 acres of short-term and LOP disturbance, respectively)
Disturbance of important Native American religious or culturally significant sites	LOP - no known sites occur on area; maximum surface disturbance of 3,250 acres	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
Environmental justice	LOP - no impact anticipated, consultation would continue	LOP - no impact anticipated, consultation would continue	LOP - no impact anticipated, consultation would continue
	SOCIOECONOMICS		
Increase in local population	LOP - a maximum of approximately 200 workers, some of which would be local, would be required at any one time; adequate infrastructure exists	Same as Proposed Action, but 30 fewer well locations would be developed	Same as Proposed Action, but 123 fewer well locations would be developed
Increase in demand for temporary housing	LOP - a maximum of approximately 200 workers, some of which would be local, would be required at any one time; numerous vacancies exist	Same as Proposed Action, but 30 fewer well locations would be developed	Same as Proposed Action, but 123 fewer well locations would be developed
Increase in demand for local government facilities or services	LOP - a maximum of approximately 200 workers, some of which would be local, would be required at any one time; adequate infrastructure exists and increased revenues would be available	Same as Proposed Action but 30 fewer well locations would be developed	Same as Proposed Action, but 123 fewer well locations would be developed
Disruption or change of character of communities	LOP - a maximum of approximately 200 workers, some of which would be local, would be required at any one time; towns developed during boom and bust cycles	Same as Proposed Action, but 30 fewer well locations would be developed	Same as Proposed Action, but 123 fewer well locations would be developed
Increase in tax revenue and royalties and stimulation of local economy	Increased federal, state, and local revenues (i.e., $243,243,000 over the first 10 years)	Similar to the Proposed Action in the first 10 years, but total revenues, royalties, taxes, and salaries and associated income effects would likely be reduced by approximately 6.7% over the LOP	Similar to the Proposed Action in the first 10 years, but total revenues, royalties, taxes, and salaries and associated income effects would likely be reduced by approximately 27.3% over the LOP

Table 2.7 (Continued)

Impact by Environmental Resource	Post-Mitigation Impacts		
	Proposed Action	Alternative A	Alternative B
	LAND USE		
Short-term reduction of animal unit months (AUMs) (grass forage) for livestock, wild horses, and wildlife	Maximum short-term (4-year) loss of 60 AUMs (1.2% of the AUMs in the J2PA)	Maximum short-term loss of 56 AUMs (1.1% of the AUMs in the J2PA)	Maximum short-term loss of 46 AUMs (0.9% of the AUMs in the J2PA)
Increase in AUMs (grass forage) following interim and permanent reclamation	Maximum increase of 55 AUMs during production and 255 AUMs after final reclamation	Maximum increase of 52 AUMs during production and 240 AUMs after final reclamation	Maximum increase of 43 AUMs during production and 201 AUMs after final reclamation
Temporary loss of mineral development opportunities	LOP - other minerals are not available in minable quantities using current technology	Similar to Proposed Action, but reduced by approximately 6%	Similar to Proposed Action, but reduced by 21-23%
Road failure	Increased potential for road rutting and/or washout due to increased number of roads and traffic	Same as Proposed Action	Same as Proposed Action
Changes in character and recreational uses of the area due to construction, presence of facilities, noise, dust, odor, and increased human activities	LOP - no developed recreation areas occur on area; a maximum of 3,250 acres of surface disturbance would occur	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
	VISUAL RESOURCES		
Modification in the basic elements (form, line, color, or texture) of visual resources by presence of facilities and equipment	LOP and until areas are successfully reclaimed - a maximum of 3,250 acres of surface disturbance in the J2PA (all of which would be within a Class IV visual resource management area) would occur	Similar to the Proposed Action, but reduced by approximately 6%	Similar to the Proposed Action, but reduced by 21-23%
	HAZARDOUS MATERIALS		
Soil, surface water, and groundwater contamination and wildlife exposure as a result of accidental spills, pipeline ruptures, etc.	LOP - impacts would be minimized by adherence to SPCCPs; a maximum of 450 well locations would be drilled	Similar to the Proposed Action, but the number of well locations would be reduced by 30	Similar to the Proposed Action, but the number of well locations would be reduced by 123

[1] Life-of-project (LOP) is projected to be 40-50 years.

3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the J2PA. The resources addressed in this EIS were identified during the scoping process or interdisciplinary team (IDT) review as having the potential to be affected by the proposed project.

Critical elements of the human environment (BLM 1988a), their status in the project area, and their potential to be affected by the proposed project are listed in Table 3.1. Three critical elements (areas of critical environmental concern [ACECs], prime and unique farmlands, and wild and scenic rivers) are not present and would not be affected; therefore, they are not addressed further. In addition to the critical elements, this EIS discusses potential effects of the proposed project on mineral resources; paleontological resources; soils; noise and odor; biological resources; socioeconomics; land use, including livestock/grazing management; and visual resources.

3.1 GENERAL SETTING

The 59,600-acre J2PA is in the central Green River Basin, a large structural basin located in western Wyoming, northwestern Colorado, and northeastern Utah. The Green River Basin is bounded on the east by the Rock Springs Uplift, on the northeast by the Wind River Mountains, on the north by the Gros Ventre Mountains, on the west by the Wyoming Range, Salt River Range, and the Fossil Syncline, and on the south by the Uinta Mountains (Love 1961). The area is located in south-central Sublette County approximately 32 mi southeast of Pinedale and 28 mi northwest of Farson, west of U.S. Highway 191 and south and east of the Green and New Fork Rivers. Access is from U.S. Highway 191 via the Luman Road (milepost 67), or from the Big Piney Cutoff Road (State Highway 351) via the Burma Road (see Map 1.1).

Topography is relatively flat, rolling, or somewhat dissected, with elevations ranging from 6,940 to 7,342 ft. The most topographical relief occurs in the northern, western, and eastern portions of the area. Surface runoff is to the Green River drainage via ephemeral washes, and occurs in all directions except to the northeast. Vegetation is dominated by sagebrush and desert shrubs. Pronghorn is the primary big game species present on the project area, and sage grouse is the principal upland game bird species.

Brown (1980) (in Martner 1986) places the project area in the general climate classification of desert. Reiners and Thurston (1996) place the project area in the Rolling Plains and Tablelands Landtype Association of the Lower Green River Basin Subsection of the Intermountain Semi-desert Province. The Rolling Plains and Tablelands Province in Wyoming is characterized by relatively low elevations, limited relief, low rainfall, and Wyoming big sagebrush and desert shrub vegetation. Surface formations on the J2PA are the Laney and Wilkens Peak Members of the Green River Formation and the New Fork Tongue of the Wasatch Formation, and surficial geology designations include residuum (the in-place accumulation of rock debris that remains after weathering), slopewash (sheet erosion)/colluvium (loose deposits at the foot of a slope brought there primarily by gravity), and alluvium (materials eroded, transported, and deposited by streams) on which are found Torriorthents (young dry soils), Haplargids (typical desert soils), and Natragids (saline desert soils).

Annual precipitation is 8-9 inches and the growing season (frost-free period) is approximately 30-40 days (Toy and Grim 1980). Mean annual temperatures at nearby weather stations are 37.3°F at Farson, 38.8°F at LaBarge, and 35.5°F at Pinedale (Martner 1986). Summer high temperatures may reach into the 90°Fs and winter lows to -40°F; however, average daily maximum temperatures during the summer (June, July, and August) are in the 70°Fs and 80°Fs at Farson and Rock Springs, and in the 70°Fs at Pinedale. Winds are strong (annual mean hourly values of 12.1 miles per hour [mph] at Rock Springs), and are predominantly from a westerly direction. Figures 3.1 and 3.2 illustrate approximate windspeeds and direction for Craven Creek and Rock Springs, Wyoming, respectively, which are the closest known monitoring locations to the J2PA. The Craven Creek site is approximately 55 mi southwest of the area and the Rock Springs site is approximately 60 mi southeast of the J2PA. Winds in the J2PA may be more from the north than those found at Craven Creek and Rock Springs.

Table 3.1 Critical Elements of the Human Environment, Jonah Field II Project, Sublette County, Wyoming, 1997.

Element[1]	Status on J2PA	Addressed in Text of EIS
Air quality	Potentially affected	Yes
Areas of critical environmental concern	None present	No
Cultural remains	Potentially affected	Yes
Farmlands (prime or unique)	None present	No
Floodplains	Potentially affected	Yes
Native American religious concerns	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Wastes, hazardous or solid	Potentially affected	Yes
Water quality	Potentially affected	Yes
Wetlands/riparian zones	Potentially affected	Yes
Wild and scenic rivers	None present	No
Wilderness	None present	Yes

[1] As listed in BLM *NEPA Handbook H-1790-1* (BLM 1988a).

The J2PA includes approximately 49 existing and/or authorized natural gas wells with approximately 30 mi of associated pipelines, 37 mi of improved roads, and 60 mi of unimproved roads, disturbing approximately 457 acres (see Table 2.1). Other existing improvements in the area include twelve water wells and numerous impoundments for livestock/wildlife watering.

3.2 PHYSICAL RESOURCES

3.2.1 Air Quality

Air quality in the J2PA is generally considered excellent; however, current and complete ambient air quality data for the J2PA and vicinity are not available. While no monitoring stations occur in the immediate vicinity of the J2PA, measured background concentrations of criteria pollutants in the region are well below the established WAAQS and NAAQS (BLM 1995a) (Table 3.2). An estimate of background air quality concentrations is necessary to combine with potential air quality impacts from the proposed project. The total estimated impact can then be compared with applicable air quality standards. It is important that the background concentration of each pollutant is based on the same averaging periods as the model predictions and applicable air quality standards.

Fine particulate (PM_{10}) data were collected at the Seedskadee National Wildlife Refuge, approximately 35-40 mi south of the J2PA (WDEQ 1996). It is assumed that total suspended particulate matter (TSP) concentrations would be the same as the measured PM_{10} values. It is also assumed that the maximum 24-hour particulate values result from wind-blown dust.

In addition to complying with WAAQS and NAAQS, certain "major" new sources or modifications (as defined by WDEQ-AQD) must comply with New

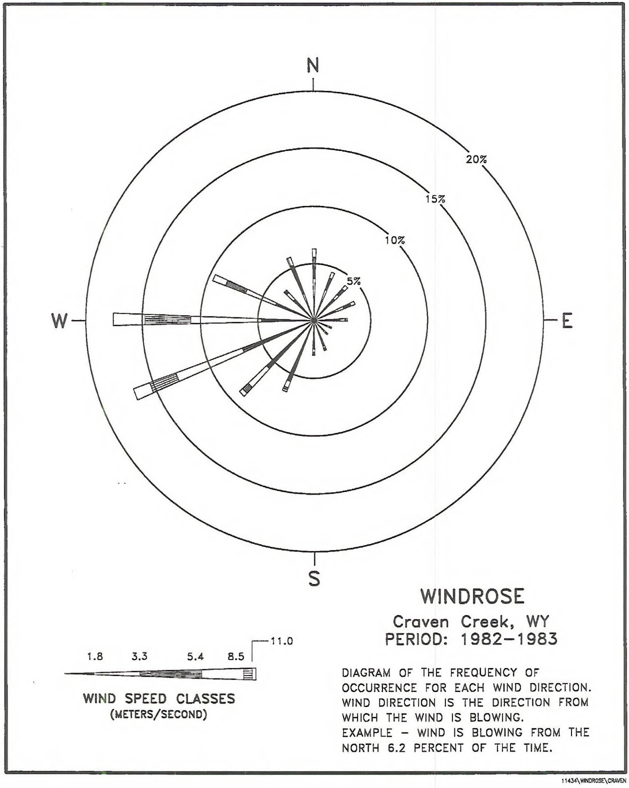


Figure 3.1 Windrose for Craven Creek, Wyoming, Jonah Field II Project, Sublette County, Wyoming, 1997.

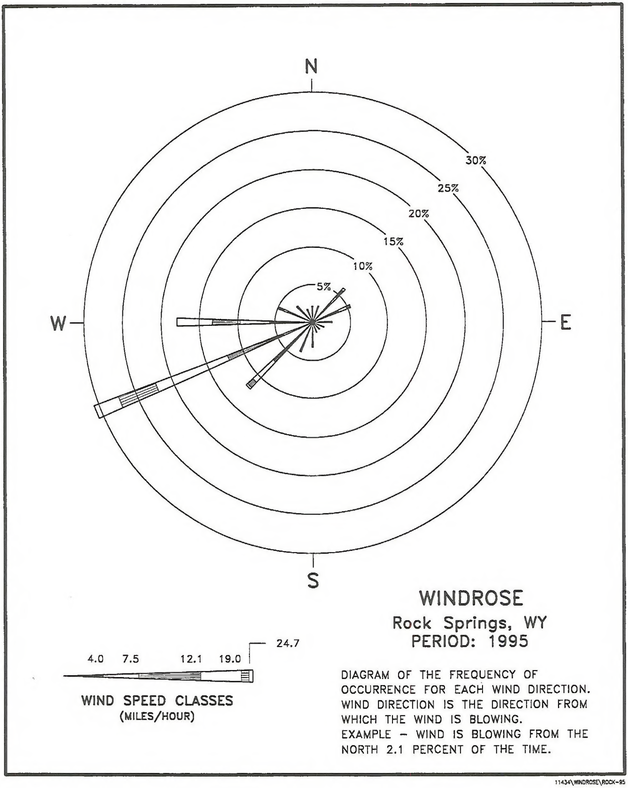


Figure 3.2 Windrose for Rock Springs, Wyoming, Jonah Field II Project, Sublette County, Wyoming, 1997.

Table 3.2 Representative Pollutant Background Concentrations and National and Wyoming Ambient Air Quality Standards, Jonah Field II Project, Sublette County, Wyoming, 1997.[1]

Pollutant[2]	Averaging Period[3]	Wyoming Standard ($\mu g/m^3$)[4]	National Standard ($\mu g/m^3$)[4]	Background Concentration ($\mu g/m^3$)
TSP	24-hour	150	N/A	45
PM_{10}	24-hour	150	150	45
	Annual	50	50	13
NO_2	Annual	100	100	10[5]
SO_2	3-hour	1,300	1,300	132
	24-hour	260	365	43
	Annual	60	80	9
CO	1-hour	40,000	40,000	3,500
	8-hour	10,000	10,000	1,500
Ozone[6]	1-hour	160	235	110

1 Adapted from BLM (1995a).
2 TSP = total suspended particulates; PM_{10} = particulates $\leq$ 10 microns in effective diameter; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; CO = carbon monoxide.
3 Short-term periods reflect maximum measured concentrations.
4 All standards except annual standards are not to be exceeded more than once annually.
5 Maximum measured NO_2 annual average was 2 $\mu g/m^3$; however, a maximum of 10 $\mu g/m^3$ was assumed based on the extensive modeling reported in BLM (1996b).
6 Ozone data (Pinedale, Wyoming [1993-1994]) represent the mean of the 90th percentile of the maximum 1-hour concentrations.

Source Performance Standards and Prevention of Significant Degradation (PSD) regulations. (This requirement generally does not apply to oil and gas field development, which is considered a "minor source.") New Source Performance Standards are specific emission limits based on the individual facility to be built, whereas PSD regulations limit the incremental air pollutant increases above a defined baseline condition, regardless of the specific baseline values. The J2PA is a PSD Class II area, and the Bridger and Fitzpatrick Wilderness Areas, approximately 20 mi northeast of the J2PA, are PSD Class I areas. Applicable PSD increments (allowable increases above "baseline") are presented in Table 3.3.

The following existing emission sources were assumed to be included in the nitrogen dioxide (NO_2) background value listed in Table 3.2: South Baxter, Union Pacific Railroad Company [UPRC] Brady, Patrick Draw, Dripping Rock, Hay Reservoir, Nichie Gulch, Big Piney/LaBarge, Hiawatha, North Evanston, South Evanston, and Whitney Canyon.

To supplement NO_2 data and to verify that modeled NO_2 contributions would not violate applicable ambient air quality standards, many nitrogen oxides (NO_x) emission sources in southwestern Wyoming were modeled. Annual average NO_2 data gathered at Craven Creek, approximately 55 mi southwest of the J2PA, showed background levels of nearly 2 $\mu g/m^3$, and the modeled background concentration was approximately 10 $\mu g/m^3$ (BLM 1996b). The predicted background concentration assumes that the potential emissions of all sources would operate at their maximum capacity simultaneously throughout an entire year (an improbable, but conservative, "worst case" assumption). By contrast, background measurements describe actual observed conditions. Although these two independent estimates of background NO_2 concentration complement each other, the "worst-case" NO_2 background concentration of 10 $\mu g/m^3$ was assumed for this air quality impact analysis.

Table 3.3 Air Pollutant Increments for Prevention of Significant Deterioration, Jonah Field II Project, Sublette County, Wyoming, 1997.[1]

		Allowable Increases ($\mu g/m^3$)	
Pollutant	Averaging Period	Class I	Class II
PM_{10}	Annual geometric mean	4	17
	24-hour	8	30
SO_2	Annual arithmetic mean	2	20
	24-hour	5	91
	3-hour	25	512
NO_2	Annual arithmetic mean	2.5	25

[1] From BLM (1996b).

Other background pollutant concentration values were provided by the WDEQ-AQD as primarily summarized in BLM (1996b). Background concentrations of carbon monoxide (CO) were taken from representative data collected by WDEQ-AQD and commercial operators and summarized in the Riley Ridge EIS. Sulfur dioxide (SO_2) data were gathered at the LaBarge Study Area at the Northwest Pipeline Craven Creek site. Ozone data were taken from Pinedale Wyoming (1993-1994).

Air Quality Related Values (AQRVs), which include the potential air pollutant effects on visibility and the acidification of surface water bodies is a concern for the PSD Class I wilderness areas of southwestern Wyoming (see Section 1.4). Visibility in the region is very good (generally greater than 70 mi), and fine particles are considered to be the main source of visibility degradation. However, the potential for impairment to existing visibility in the Bridger and Fitzpatrick Wilderness Areas has previously been identified (BLM 1996b). Atmospheric deposition (acid rain) is monitored as part of the National Acid Deposition Program/National Trends Network near Pinedale, Wyoming. Although the monitored deposition values are much below those considered to damage vegetation (BLM 1996a), even low levels of acid deposition may exceed the natural neutralization capacities of certain high mountain lakes in the nearby wilderness areas (BLM 1996b). The USFS has identified specific AQRV "Limits of Acceptable Change" which they use to evaluate potential air quality impacts within their Wilderness Areas (USFS 1993).

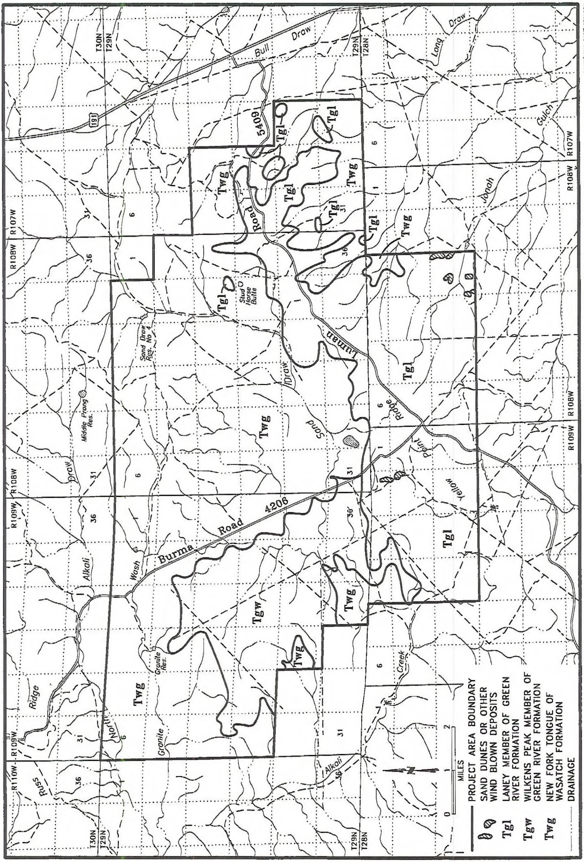
The most significant air pollutant throughout the J2PA is particulate matter, primarily as fugitive dust (uncontrolled, wind-carried particles), from natural sources, roads, and other disturbances (e.g., gas exploration and development, recreation, and livestock grazing), especially during dry, windy periods.

In 1996, the BLM (1996b) listed 110 existing emission sources in the Green River/Ham's Fork Basin that were permitted a total of 128,490 tons/year of NO_x emissions. Two sources, the Bridger and McNaughton coal-fired power plants, contributed 66.3%, and nine other sources (primarily trona plants) contributed an additional 17.4% of the total emissions. Oil and gas related facilities contributed the remaining 16.3%.

3.2.2 Geology

Surface geology is dominated by the Laney and Wilkens Peak Members of the Green River Formation and the New Fork Tongue of the Wasatch Formation (Map 3.1). The Laney Member is composed of oil shale and marlstone, whereas the Wilkens Peak Member consists of tuffaceous sandstone, shale, marlstone, and evaporites in subsurface sections. The New Fork Tongue consists of mudstone, sandstone, and thin limestone beds.

The J2PA is underlain by the main body of the Wasatch Formation, the Fort Union and Lance Formations, Fox Hills Sandstone, Lewis Shale, the Mesaverde Group (i.e., the Almond Formation, Ericson Sandstone, Rock Springs Formation, and the Blair Formation), Baxter Shale, and the Frontier



Map 3.1 Surface Geology, Jonah Field II Natural Gas Project, Sublette County, Wyoming, 1997.

Formation. The Lance Formation is targeted for gas production by this project (see Figure 2.2). The geological formations underlying the J2PA would not be adversely affected by the proposed project and, therefore, are not further discussed in this EIS.

3.2.3 Geologic Hazards

The overthrust belt, located on the western edge of the Green River Basin, is seismically active, and scores of earthquakes have occurred in a north/south-trending belt between Big Piney and Evanston in recent years. An earthquake with a 3.3 magnitude (Richter Scale) occurred within the J2PA in 1978 (Case et al. 1990). The epicenter was located in the northern portion of T29N, R108W. There is one fault located approximately 6 mi east of the area, but it is not known whether this fault has been active recently. There are no known active faults within the J2PA, so overall potential for seismicity is low.

There are no known landslides or areas of subsidence within the J2PA (personal communication, October 1996, with Jim Case, Wyoming Geological Survey).

3.2.4 Paleontology

The important fossil record of the Green River Basin is well known (BLM 1992a). Table 3.4 provides information on the various geologic formations present on and in the vicinity of the J2PA and their paleontologic potential.

The Green River Formation contains fossils from each of the five biological kingdoms and is well known for its abundant fish fossils (Grande 1984). The Laney Member is especially fossiliferous. Terrestrial mammalian fossils are not common because the Green River Formation was formed predominantly from lake deposits; however, reptile (crocodile, alligator, snake, lizard), amphibian (frog, salamander), bird (pelican, grouse, shorebird, and small perching bird), and insect and other invertebrate fossils are abundant. Although uncommon, mammalian fossils, including marsupials, insectivores, primates, rodents, carnivores, and ungulates, have been recovered.

The fossil flora of the Laney Member is not well studied, but includes sycamore, horsetail, and lily pads. Other members of the Green River Formation, however, contain a diverse mixture of trees, shrubs, and flowers, suggesting that the fossil flora of the Laney Member may be more diverse than is now known. Insects and other invertebrates (gastropods, arthropods), algae, fungi, flagellates, and bacteria also have been recovered from the Green River Formation.

Scientific study of the paleontological resources in the vicinity of the J2PA is growing. In 1996, paleontologists from the University of California, Berkeley, conducted fieldwork in the area, and their research indicates that the traditional view of the northerly extent of ancient Lake Gosiute may be incorrect. This finding has led to the discovery of scientifically important vertebrate and other fossils in the vicinity of the J2PA.

A review of museum and university records identified 39 fossil localities of importance in the vicinity of the J2PA, and an additional 15 localities of importance were identified in a publication dealing with geology and mammalian paleontology in the New Fork - Big Sandy area of Sublette County, Wyoming (Erathem-Vanir Geological Consultants 1996). No known localities are within the J2PA, although several are within 1 mi and it is likely that significant fossils are present in the J2PA.

3.2.5 Mineral Resources

3.2.5.1 Oil and Gas

In July 1996, there were 15 producing gas wells in the Jonah Field, the only active field within the J2PA (personal communication, October 1996, with Cheryl Ondler, WOGCC). By January 1, 1997, it is anticipated that approximately 30 wells will be completed in the area. Forty-nine wells are currently authorized for the J2PA (see Map 2.1).

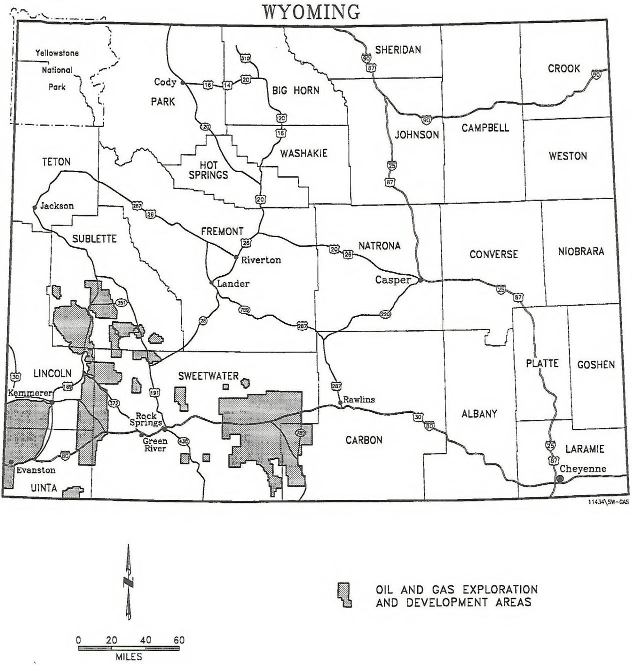
The Jonah Field was discovered in 1977 (WOGCC 1994), and as of August 1996, 93,824 bbl of oil and approximately 7,900 mmcf of natural gas had been produced. During 1996, 26,848 bbl of oil and 2,500 mmcf of gas were produced as of August.

Considerable oil and gas exploration and development is occurring in southwestern Wyoming, and it is anticipated that oil and gas development and production activities will continue for 50 plus years into the future. Map 3.2 shows the location of the oil and gas exploration and development areas in southwestern Wyoming.

Table 3.4 Summary of Surface Geologic Deposits and Paleontologic Resources, Jonah Field II Project, 1997.[1]

Deposit[2]	Geologic Age	Type of Deposit/ Environment of Deposition	Thickness	Fossil Resources	Fossil Potential
Alluvial sediments	Holocene	Unconsolidated silts, sands of valleys and plains. Terrestrial.	<20 ft	None	Low
Terrace deposits	Holocene	Gravels, silts and sands that predate current erosional cycle. Terrestrial-fluvial.	<40 ft	None	Unknown, probably low
Green River Fm Laney Shale Mbr LaClede Bed	Middle Eocene	Chiefly oil shale, lesser algal limestone, sandstone, claystone and tuff. Lacustrine, accumulated during renewed expansion of Lake Gosiute.	<100 ft	Vertebrates, invertebrates, trace fossils	High
Green River Fm Wilkins Peak Mbr (upper part)	Early-Middle Eocene	Chiefly brown or black oil shale interbedded with gray or green mudstone, evaporitic. Lacustrine, deposited during re-expansion of Lake Gosiute (upper).	<150 ft	Vertebrates, invertebrates, plants	High
Green River Fm Tipton Shale Mbr Scheggs Bed	Early Eocene	Chiefly oil shale, lesser algal limestone, dolomite, sandstone and mudstone. Lacustrine, deposited during first major expansion of Lake Gosiute.	<50 ft	Vertebrates, invertebrates	High
Green River Fm Farson Ss Mbr	Early Eocene	Chiefly parallel bedded, gray fine-grained sandstone, weathers to cliffs and ledges. Lacustrine-Deltaic.	300-400 ft	Vertebrates, trace fossils	High
Wasatch Fm Cathedral Bluffs Mbr	Early-Middle Eocene	Varicolored, chiefly red sandstone and mudstone. Terrestrial, fluvial, floodplain, accumulated lateral to Lake Gosiute along basin margin.	<500 ft	Vertebrates, plants	High
Wasatch Fm Alkali Creek Tongue	Early Eocene	Interbedded brown, green, and gray sandstone, siltstone, mudstone, and shale; locally conglomeratic. Chiefly terrestrial-fluvial to foodplain; some Lacustrine.	<100 ft	Vertebrates, invertebrates, plants	High

[1] Adapted from Erathem-Vanir Geological Consultants (1996).
[2] Fm = formation; Mbr = member; Ss = sandstone.



Map 3.2 Southwestern Wyoming Oil and Gas Development Areas.

3.2.5.2 Coal

The J2PA is located within the Green River Basin Coal Field (Jones 1991) and is underlain by coal-bearing rocks; however, the potential for coal development is low because coal beds are thin and of limited quality and/or quantity (BLM 1987a).

3.2.5.3 Oil Shale

Within the Green River Basin, the Laney Member of the Green River Formation contains oil shale, and oil shale reserves are known to occur in the southwestern portion of the PRA. However, none are known to occur within the J2PA, and the potential for future oil shale development in the area is low (BLM 1987a).

3.2.5.4 Trona

Trona beds are extensive in the Wilkens Peak Member of the Green River Formation, but trona is not known to occur in strata underlying the J2PA.

3.2.5.5 Other Minerals

The only other mineral resources known to occur within the J2PA are sand and gravel (Harris et al. 1985). Uranium, copper, gypsum, and gold may occur in small, scattered noncommercial quantities, but there are no known proposals to develop these minerals. Other minerals (e.g., bentonite, limestone) are not known to occur in the area in minable quantities (Harris et al. 1985; BLM 1987a).

3.2.6 Soils

Twenty-two soil mapping units occur within the J2PA (ERO Resources Corporation 1988). Table 3.5 lists the map units and describes their use limitations and management considerations for this project. The Transportation Plan (see Appendix A) contains further detail on soil characteristics, use and management considerations, series/map unit correlations, criteria for establishing soil suitability for the various uses, and soils maps of the J2PA.

Most soils within the J2PA have characteristics that limit their suitability for road construction and may inhibit successful reclamation (see Appendices A and B). The primary factors limiting soils for road construction are shallow depths to rock, low strength, shrink-swell potential, and steep slopes. Reclamation potential is limited by alkalinity and salinity; excess stones; sand, clay, and lime; shallow depths; and steep slopes.

Several known sand dunes and other windblown deposits occur in the J2PA (see Map 3.1) (Case and Boyd 1987; personal communication, October 1996, with Jim Case, Wyoming Geological Survey), and it is likely that smaller areas of sand dunes or windblown deposits occur within the J2PA. The Kandaly and Spool Variant soil series (map units 120, 123, and 126 contain these soils [Table 3.5]) are very sandy, highly susceptible to wind erosion, and may be associated with dune formations or windblown deposits. However, these soil types are not common within the project area, and sand dunes and other windblown deposits that do occur probably are limited in size and areal extent.

Major soils within the J2PA include the Garsid-Monte Association on 1-6% slopes; the Garsid-Terada-Langspring Variant complex on 1-6% slopes; the Vermillion Variant-Seedskadee-Fraddle complex on 0-3% slopes; and the Haterton-Garsid complex on 1-8% slopes (see Table 3.5). These mapping units collectively cover approximately 60% of the J2PA and occur extensively throughout the central and southern portions of the area. Limitations associated with these principal soils include shallow depth to rock, alkalinity, low strength, stoniness, excess lime, and shrink-swell potential. Steep slopes may limit development and reclamation potential in localized areas, but these soils are typically located on gently sloping, undulating uplands.

Soils in the northwestern, north-central, and eastern portions of the J2PA occur in a complex mosaic across dissected topography, badlands, and drainages. The Horsely-Badlands-Boltus complex on 15-65% slopes occupies dissected areas where the water erosion hazard is severe, and soils are limited by shallow depths, low strength, and steep slopes. The Dines-Clowers-Quealman complex on 0-3% slopes and the Monte-Leckman complex on 1-6% slopes, occur adjacent to drainage channels and on terraces and alluvial fans. These soils are limited by alkalinity, salinity, shrink-swell potential, stoniness, excess sand, and low strength.

Several soils (i.e., the Terada-Huguston-Fraddle, Monte-Leckman, Fraddle-Tresano, Huguston-Horsely-Terada, Garsid-Monte, and Baston-Boltus-

Table 3.5 Soil Use and Management Considerations, Jonah Field II Project, Sublette County, Wyoming, 1997.

Map Unit No.	Map Unit Name	Use and Management Considerations
100	Horsley-Badlands-Boltus complex, 15-65% slopes	Steep broken uplands and sideslopes. Shaley badlands sites. Severe water erosion hazard. Limited for construction activities due to shallow depths to bedrock, low strength, steep slopes. Rehabilitation difficult due to excess salt and clayey textures.
101	Haterton-Garsid-Tasselman complex, 8-40% slopes	Strongly sloping uplands and sideslopes. Loamy uplands. Limited for construction activities due to shallow depth to bedrock and steep slopes. Rehabilitation difficult for similar reasons.
102	Langspring Variant-Langspring complex, 1-10% slopes	Gently sloping to nearly level mesa tops and uplands. Loamy uplands. Generally suitable for road construction. Rehabilitation limited due to excess lime and small stones.
103	Terada-Huguston-Fraddle association, 1-12% slopes	Gently sloping to rolling lands. Loamy uplands. Construction activities limited due to shallow depth to bedrock and steep slopes. Rehabilitation limited for similar reasons.
105	Fluvents, saline-sodic, 0-2% slopes	Low terraces and floodplains. Saline lowlands. Construction activities limited due to wetness. Rehabilitation potential low due to excess salts.
106	Monte-Leckman complex, 1-6% slopes	Nearly level to gently sloping alluvial fans and drainageways. Loamy, saline uplands. Generally suitable for road construction. Rehabilitation limited by excess sands or small stones.
108	Dines-Clowers-Quealman complex, 0-3% slopes	Nearly level to gently sloping drainageways and alluvial terraces. Loamy sites, saline uplands. Limited for road construction due to low strength. Rehabilitation potential limited by excess salt, sand, and small stones.
110	Fraddle-Tresano complex, 1-8% slopes	Rolling uplands, upper dissected fans, and valley-filling slopes. Loamy uplands. Limited for construction activities and reclamation due to thin soils.
113	Haterton-Garsid complex, 1-8% slopes	Nearly level to gently sloping uplands and sideslopes. Shallow loamy and loamy sites. Construction limited by shallow depth to bedrock, slope, and low strength. Rehabilitation limited by shallow depth to bedrock and steep slopes.
114	Ouard-Ouard Variant-Boltus complex, 1-8% slopes	Nearly level to gently sloping uplands. Shallow loamy, shallow clayey, and shaley sites. Limited due to low strength and shallow depth to bedrock. Rehabilitation limited due to thin soils.
116	Huguston-Horsley-Terada complex, 6-30% slopes	Gently sloping to moderately steep sideslopes and rolling uplands. Shaley and loamy sites. Limited due to shallow depth to bedrock, low strength, and steep slopes. Rehabilitation limited by shallow depths and slopes.
119	Garsid-Monte association, 1-6% slopes	Gently undulating uplands. Loamy sites. Construction limited by thin soils, low strength, and steep slopes. Rehabilitation limited by steep slopes.

Table 3.5 (Continued)

Map Unit No.	Map Unit Name	Use and Management Considerations
120	Kandaly-Terada-Huguston complex, 1-12% slopes	Nearly level to rolling uplands. Sands and loamy sites. Construction limited due to shallow depth to bedrock and steep slopes. Rehabilitation limited by sandy textures, steep slopes, and shallow depth to bedrock.
121	Garsid-Terada-Langspring Variant complex, 1-6% slopes	Undulating uplands. Loamy sites. Construction limited due to thin soils, low strength, and steep slopes. Rehabilitation limited by steep slopes, small stones, and excess lime.
122	Baston-Boltus-Chrisman association, 0-6% slopes	Undulating and dominantly concave uplands. Clayey, shaley, and saline upland sites. Construction limited by low strength, shrink-swell potential, thin soils, and steep slopes. Rehabilitation limited by thin soils, clayey textures, excess salt, and steep slopes.
123	Spool Variant-Ouard Variant-San Arcacio Variant complex, 4-25% slopes	Gently sloping to steep sideslopes and rolling uplands. Shallow sandy, shallow clayey, and loamy sites. Construction limited by shallow depth to bedrock and low strength. Rehabilitation limited by shallow depths, small stones, sandy or clayey textures, or steep slopes.
124	Fraddle-Ouard-San Arcacio Variant complex, 3-8% slopes	Rolling uplands. Loamy and shallow loamy sites. Construction limited by thin soils and low strength. Rehabilitation limited by thin soils, clayey textures, or small stones.
125	San Arcacio-Saguache association, 0-3% slopes	Old floodplains, fans, and terraces. Loamy and sandy sites. Generally suitable for road construction. Rehabilitation limited by small stones.
126	Kandaly-Boltus association 1-6% slopes	Sand dunes over residual Laney Shale uplands. Sands and shaley sites. Limited for construction due to thin soils, low strength, and steep slopes. Rehabilitation limited by sandy or clayey textures, excess salt, or steep slopes.
127	Vermillion Variant-Seedskadee-Fraddle complex, 0-3% slopes	Nearly level uplands and mesas. Shallow loamy and loamy sites. Limited for construction due to shallow depth to bedrock, low strength, and thin soils. Rehabilitation limited by stoniness, excess lime, and thin soils.
128	Fraddle-Ouard-San Arcacio Variant complex, 0-3% slopes	Nearly level upland surfaces. Loamy and shallow loamy sites. Construction limited by low strength and shallow depth to bedrock. Rehabilitation limited by thin soils and small stones.
BL	Badlands	Raw exposed shale and soft sandstone, siltstone, and marl.

Chrisman complexes/associations) may be good sources for topsoil (ERO Resources Corporation 1988). The Spool Variant-Ouard Variant-San Arcacio Variant, Fraddle-Ouard-Sand Arcacio Variant, and San Arcacio-Saguache complexes/associations may be good gravel sources.

3.2.7 Water Resources

3.2.7.1 Surface Water

Portions of four watersheds are contained within the J2PA--Long Island, Waterhole Draw, Sublette Flats, and Eighteen Mile (Map 3.3). Approximately 40,300 acres of the 186,200-acre Long Island watershed drains all but the eastern and southern portion of the J2PA (68%), and is rated moderate for salinity and sediment production (0.2-0.5 acre-ft/mi^2/year) and relatively poor for vegetative condition, with a high potential for overall improvement (BLM 1994b). Approximately 12,700 acres of the 212,100-acre Expanded Waterhole Draw watershed drains the eastern portion of the J2PA (21%). The watershed is rated low for salinity, relatively low for sediment production (0.1-0.2 acre-ft/mi^2/year), and relatively poor for vegetative condition, with a low potential for overall improvement. Approximately 2,900 acres of the 111,500-acre Sublette Flats watershed drains the southeastern corner of the J2PA (5%). It is rated moderate for salinity and sediment production (0.2-0.5 acre-ft/mi^2/year) and relatively poor for vegetative condition, with a high potential for overall improvement. Approximately 3,700 acres of the 134,700-acre Eighteen Mile watershed drains the south-central portion of the J2PA (6%). This watershed is rated moderate for salinity and sediment production (0.2-0.5 acre ft/mi^2/year) and relatively poor for vegetative condition, with a moderate potential for overall improvement.

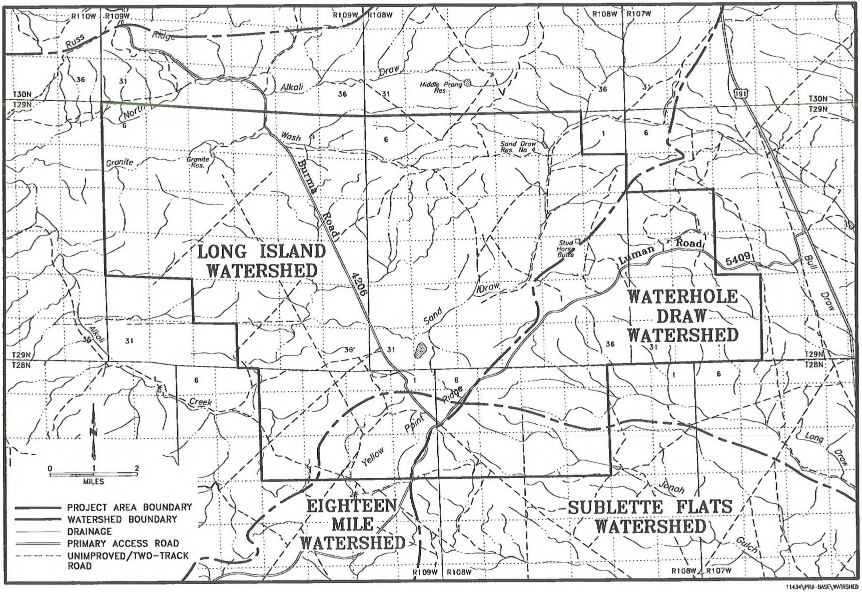
The J2PA is drained by ephemeral washes which exit the project area in all directions except northeast. To the north, channels (including Granite Wash) flow into North Alkali Creek. Sand Draw bisects the area, flowing southwest into Alkali Creek, which exits from the southwestern corner of the area. The PRA RMP indicates that Sand Draw and Alkali Creek are prone to flooding (BLM 1987a). However, flooding may occur in any of the ephemeral draws within the J2PA after intense rainstorms. Alkali Draw and adjacent channels are in poor condition due to lack of streambank vegetation, and these areas are exceedingly prone to erosion due to disturbance.

To the south, drainage is into Buckhorn Draw and East Buckhorn Draw. East of Yellow Point Ridge, drainages flow southeast into Jonah Gulch and Bull Draw. The major rivers adjacent to the J2PA are the Big Sandy, New Fork, and Green Rivers, which are in the upper Colorado River drainage.

Surface Water Quality. Alkali Creek and Granite Wash are Class 4 streams (WDEQ 1990a), which are defined as surface waters other than Class 1 waters which are determined to not have the hydrologic or natural water quality potential to support fish, and include all intermittent and ephemeral streams. Class 4 waters receive protection for agricultural uses and wildlife watering. The Big Sandy and New Fork Rivers, which are outside the J2PA, are Class 2 waters (i.e., surface waters, other than Class 1 waters, that presently support game fish or have the hydrologic and natural water quality potential to support game fish or include nursery areas or food sources for game fish). Downstream from the New Fork River, the Green River is Class 2.

No waters classified by the State of Wyoming as "not supporting beneficial uses" pursuant to Section 303(d) of the Clean Water Act (CWA) would be affected by the project. The CWA requires states to develop Total Maximum Daily Loads (TMDLs) for pollutants in waters that do not meet water quality standards. Runoff from agricultural and urban areas appears to be the primary source for water quality impairment. Once TMDLs are established by Wyoming and approved by the EPA, the BLM will work with the state to meet TMDLs.

Surface Water Use. The major surface water uses in the J2PA are livestock and wildlife watering. Numerous impoundments and playas (internally drained, closed basins that periodically hold water) occur throughout the area. Several reservoirs (e.g., Warden, Lumen, Granite, Wild Horse, Sand Draw No. 4) have been constructed along drainages and may be semipermanently, seasonally, or temporarily flooded. There are approximately 20 stockponds scattered throughout the area. One large playa, located on private surface in Section 32, T29N, R108W, probably provides excellent wildlife habitat during seasonal wet periods. Approximately 23 other



Map 3.3 Watersheds, Jonah Field II Project, Sublette County, Wyoming, 1997.

smaller playas or depressions probably have limited value as wildlife watering/habitat areas. No irrigation is occurring within or adjacent to the project area.

3.2.7.2 Groundwater

Groundwater within the J2PA occurs in both confined (artisan) and unconfined (water table) aquifers (Welder 1968). Unconfined aquifers occur near ground surface and include aquifers in Quaternary alluvium and the upper portions of Tertiary sedimentary rocks. Confined aquifers include the lower portions of Tertiary rocks and all underlying strata. Project activities are likely to encounter, in descending order, the following water-bearing formations: unconsolidated Quaternary alluvial and aeolian (windblown) deposits; the Laney Member and Wilkens Peak Member of the Green River Formation, the main body of the Wasatch Formation, the Lance Formation, Lewis Shale, and the Mesaverde Group (i.e., the Almond Formation, Ericson Sandstone, Rock Springs Formation, and the Blair Formation). The major aquifers are 1) Quaternary aquifers, 2) sandstones in the Wasatch Formation, and 3) discontinuous sand lenses in the Laney Member of the Green River Formation. Most of the other formations contain significant amounts of water but are limited as a groundwater source due to water quality problems (i.e., the Wilkens Peak Member of the Green River Formation) or depth to the aquifer (i.e., the Fort Union and Lance Formations and the Mesa Verde Group).

Water for drilling likely would be obtained from Quaternary aquifers (<600 ft deep), possibly the Laney Member of the Green River Formation or the main body of the Wasatch Formation (ground surface to approximately 9,000 ft deep), and produced water from the Lance Formation (approximately 9,000 to >12,000 ft deep).

The Quaternary aquifer system is highly permeable and contains significant amounts of water. Well yields are typically 100 gal per minute (gpm) and may be as high as 500 gpm. The Laney Member has good potential for groundwater production (1-75 gpm). Well yields from the Wasatch aquifer may range from 1-3,000 gpm, but are typically less than 500 gpm. Porosity of the Lance Formation is moderate, but there are no data regarding yields from wells or springs. Twelve existing water wells are known to occur on the J2PA.

Groundwater Quality. Sandstones in the Green River and Wasatch Formations contain fresh to slightly brackish water, with TDS concentrations of 500-3,000 milligrams per liter (mg/l). Groundwater tends to become more saline with increasing depth below the surface. The secondary standard for TDS in drinking water is 500 mg/l (WDEQ 1990), and much of the water in the area, except in Quaternary aquifers, exceeds this standard.

Quaternary aquifers generally supply water suitable for domestic uses (Ahern et al. 1981). TDS concentrations are typically 100-200 mg/l in headwater areas and increase to 700 mg/l along the Green River. In upstream areas, calcium and bicarbonate are the major constituents; further downstream, sodium and sulfate concentrations increase. Groundwater in the Laney Member of the Green River Formation contains 2,000-7,000 mg/l TDS. Sodium and sulfate are the main salts, and calcium concentrations are high. Water quality in the Wilkens Peak Member is typically poor, with TDS concentrations of 7,000-100,000 mg/l, depending on location. Sodium bicarbonate and sodium carbonate are the dominant ions.

Water quality within the Wasatch aquifer is highly variable. Water quality tends to decline from recharge areas, where it is predominantly a calcium-bicarbonate type, towards the basin center, where sodium and chloride replace calcium (Bruce 1993). TDS concentrations are 100-6,000 mg/l (Ahern et al. 1981).

Several other groundwater components are known to exist in concentrations in excess of secondary drinking water standards (Ahern et al. 1981). Fluoride concentrations exceeded standards in 34% of wells completed in Tertiary aquifers, most commonly in the Laney Member in the Big Sandy River drainage (up to 400 mg/l). Fluoride concentrations also were high in water from the Wasatch Formation where it intertongues with the Laney Member, as well as in the Wilkens Peak Member. The nitrate and sulfate standards are also commonly exceeded in the Tertiary aquifers (Ahern et al. 1981), and uranium, arsenic, and selenium standards may be exceeded in localized areas.

Natural gas well logs from existing wells in the J2PA indicate that below 3,700 ft, the Fort Union and Lance Formations contain discrete water-bearing sandstones

with water quality ranging from brackish to saline (TDS from 3,000 to >15,000 mg/l). Water quality is generally more saline at greater depth; however, at depths of 7,500 to 12,000 ft, water with TDS of 650 to 2,600 mg/l can be found in some sands. Sands bearing water of this quality are found between sands with water having 13,000 to 15,000 mg/l TDS. Water quality of produced water from the Lance Formation is shown in Table 2.6.

Groundwater Use. Groundwater contributes only a small fraction (approximately 2.5%) of the water used within the Green River Basin (Ahern et al. 1981). In the J2PA, its primary uses are for stock and wildlife watering and oil and gas development. No irrigation is occurring within the area.

3.2.8 Noise and Odor

The relative lack of development in the J2PA results in noise levels that can best be characterized as rural or natural. Wind, thunderstorms, livestock, and wildlife are the primary sources of noise, although airplane and vehicular noise are also present. Other human-caused noises in or adjacent to the area are associated with the exploration and/or production of natural gas and with recreational activities. No specific noise level data are available; however, noise in the J2PA is probably in the range reported for "farm in valley" sites by Wyle Laboratories (1971) for the EPA. Median noise levels for these sites ranged from 29-39 A-weighted decibels (dBA), depending on time of day. Background noise levels at locations similar to the J2PA have been predicted to be as high as 40 dBA due to traffic and wind conditions (BLM 1995b).

Noise sensitive areas in the J2PA include sage grouse leks during the breeding season and occupied raptor nests. There are no humans residing on or immediately adjacent to the area.

Existing natural gas development activities generate additional noise from construction, drilling, and traffic. Drilling rig and well testing operations produce noise levels of up to 115 dBA with a noise level of 55 dBA at 3,500 ft from the source (BLM 1991b). Increased noise levels associated with construction activities range from 70 dBA to over 90 dBA within 50 ft of the activity; however, these noise levels attenuate with distance at a rate of an approximately 6 dBA reduction in noise level with each doubling of distance (Thumann and Miller 1986).

No specific data on odors are available from the J2PA; however, odors present in the area, other than the natural odors of vegetation and wildlife, are likely associated with vehicle emissions along roads, natural gas development operations, and livestock concentration areas. Odors are likely to be quickly dispersed by winds.

3.3 BIOLOGICAL RESOURCES

3.3.1 Vegetation

3.3.1.1 Plant Communities

Vegetation in the J2PA is dominated by low density stands of Wyoming big sagebrush grasslands, with some areas--especially in the eastern portion--vegetated with saltbush or cushion plant-dominated barren land (BLM 1987b; Intermountain Ecosystems LC 1996; Reiners and Thurston 1996). Important plants in the Wyoming big sagebrush grasslands include Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*), thickspike wheatgrass (*Elymus lanceolatus*), Indian ricegrass (*Oryzopsis hymenoides*), Sandberg bluegrass (*Poa secunda* var. *secunda*), and rabbitbrush (*Chrysothamnus* spp.) (Fertig 1993). Needle-and-thread (*Stipa comata*) is a major species on sandy soils.

The saltbush community includes shadscale (*Atriplex confertifolia*), Gardner's saltbush (*Atriplex gardneri* var. *gardneri*), winterfat (*Krascheninnikovia lanata*), Indian ricegrass, and thickspike wheatgrass. Dominant species in the cushion plant community--which is characterized by the near absence of sagebrush and low overall vegetative cover--include fringed sagebrush (*Artemisia frigida*), squarestem phlox (*Phlox muscoides*), spoonleaf milkvetch (*Astragalus spatulatus*), goldenweed (*Haplopappus* spp.), Hooker sandwort (*Arenaria hookeri*), cutleaf daisy (*Erigeron compositus*), mat beardtongue (*Penstemon caespitosus*), and silky locoweed (*Oxytropus sericea*).

While noxious weeds are not presently considered a problem in the J2PA, there is potential for noxious weed invasion on disturbed sites in the area. Potential invader species include black henbane (*Hyoscyamus*

niger), Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), Dyer's woad (*Isatis tinctoria*), spotted knapweed (*Centaurea maculosa*), and halogeton (*Halogeton glomeratus*). Sources of invasion include gravel obtained from outside the J2PA.

3.3.1.2 Wetlands

Wetlands are protected under Section 404 of the Clean Water Act (33 CFR 1251 et seq.) and Executive Order 11990 (Protection of Wetlands) and are considered sensitive and valuable resources. The locations and types of wetlands within the J2PA were determined from USFWS Draft National Wetland Inventory maps (USFWS 1989b). Sixty-two potential wetlands were identified within the area. Most ephemeral channels within the J2PA have associated riverine wetlands that are temporarily flooded. Numerous stockponds, scattered throughout the area, are considered potential wetlands, and most are less than 1.0 acre in size and occur along ephemeral washes. Reservoirs (e.g., Granite, Sand Draw No. 4, Wild Horse, Warden, and Luman Reservoirs) in the area, are classified as temporarily, seasonally, or semipermanently flooded, and are 5-10 acres in size. There are also a large number of small depressions or playas, also less than an acre in size and classified as temporarily, seasonally, or semipermanently flooded. The large playa located on private surface in Section 32, T29N, R108W, is classified as temporarily or seasonally flooded and occupies approximately 25 acres.

3.3.2 Wildlife and Fisheries

3.3.2.1 Big Game

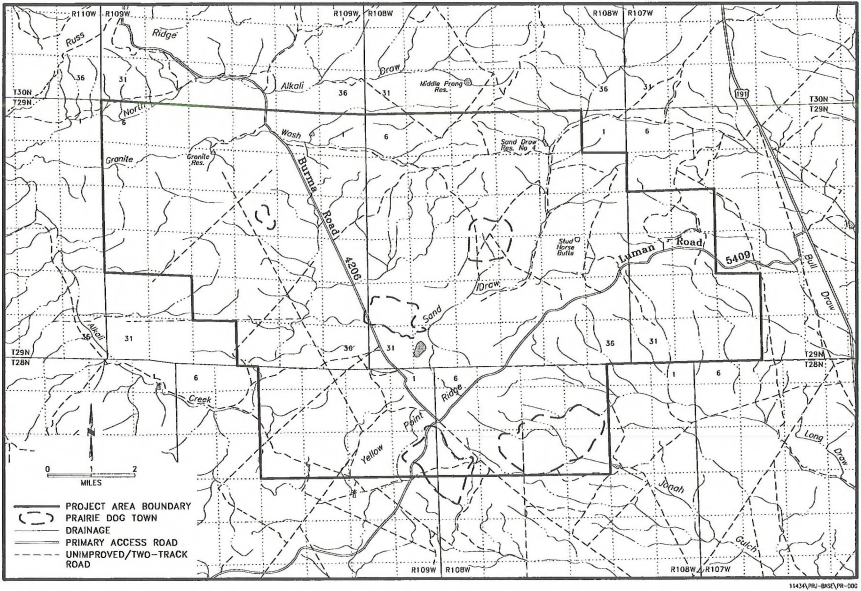
Pronghorn is the only big game species that regularly inhabits the J2PA. The entire project area is within the Sublette Herd Unit and is classified as spring/summer/fall habitat. The Sublette Herd Unit occupies approximately 9,200 mi², including most of the Green River drainage north of Interstate 80 (I-80) exclusive of the Black's Fork and Ham's Fork drainages. Limited portions of other drainages, including the Gros Ventre/Hoback River area near Jackson Hole 150 mi north of I-80, are also included. Within these boundaries, Sublette Herd Unit pronghorn migrate farther between seasonal ranges than any other pronghorn in Wyoming. Approximately 6,700 mi² (73%) of the herd unit is occupied habitat, and approximately 4,800 mi² (72%) of the occupied habitat is spring/summer/fall habitat. The WGFD population objective for the Sublette Herd Unit is 40,000 animals (raised from 19,400 to 30,000 in 1992, and from 30,000 to 40,000 in 1994), and the population averaged about 32,920 from 1990 to 1994. The 1995 population was estimated at 31,300 (personal communication, September 1996, with Tom Christiansen, Wildlife Biologist, WGFD, Green River; WGFD 1996a).

One of two major migration corridors for the Sublette Herd Unit runs north and south along both sides of Highway 191 between Farson and Pinedale (Raper et al. 1989). This corridor funnels animals from areas north of the Big Sandy River.

3.3.2.2 Other Mammals

Other mammals that are known to occur or are likely to occur in the J2PA based on observations and range and habitat preference (Clark and Stromberg 1987; WGFD 1992, 1996b; personal communication, June 30, 1996, with Laura Gianakos, Wyoming Natural Diversity Database [WYNDD], Laramie, Wyoming) include the following: dwarf shrew; ten bat species (California myotis, small-footed myotis, Yuma myotis, little brown myotis, long-legged myotis, silver-haired bat, big brown bat, hoary bat, Townsend's big-eared bat, and pallid bat); four species of hares and rabbits (pygmy rabbit, Nuttall's cottontail, desert cottontail, and white-tailed jackrabbit); five squirrel species (least chipmunk, Uinta ground squirrel, Wyoming ground squirrel, thirteen-lined ground squirrel, and white-tailed prairie dog); northern and Idaho pocket gophers; six species of new world rats and mice (Ord's kangaroo rat, deer mouse, grasshopper mouse, bushy-tailed woodrat, sagebrush vole, and long-tailed vole); coyote and red fox; four mustelid species (long-tailed weasel, badger, western spotted skunk, and striped skunk; and bobcat. Porcupine, moose, and mule deer have been observed in the vicinity of the project area, but are not likely residents.

Anderson (1996) surveyed prairie dog colonies in much of the J2PA. He reported finding five principal areas of concentrated, historic white-tailed prairie dog use ranging in size from 62 to 1,546 acres, with burrow densities of 0.8-46 burrows/acre (Map 3.4). Although the colonies were easily visible from the air, ground surveys revealed few if any prairie dogs in all but the smallest colony. Many of the burrows appeared to have been occupied by Uinta ground



Map 3.4 White-tailed Prairie Dog Colonies, Jonah Field II Project, Sublette County, Wyoming.

squirrels rather than prairie dogs, and a sizeable population of Uinta ground squirrels was observed. The two largest prairie dog colonies are in the southern portion of the J2PA, an area with little topographic relief.

3.3.2.3 Raptors

Six species of raptors were noted during a raptor survey conducted on all but the far eastern portion of the J2PA in April-May 1996 by Anderson (1996): American kestrel (two observations); ferruginous hawk (three observations); golden eagle (nine observations); northern harrier (one observation); red-tailed hawk (one observation); and rough-legged hawk (one observation). Eleven raptor nests/nest sites were inventoried (Map 3.5), eight of which were ferruginous hawk nests and three of which were of unknown origin. The nests were located in areas of greater topographical relief, primarily in the eastern and western portions of the J2PA, or within a 1-mi buffer around the J2PA. Three of the ferruginous hawk nests were active in 1996, and it is assumed that at least three ferruginous hawk nesting territories are present on the area. An additional raptor survey of the J2PA and surrounding area will be conducted in 1997 to further identify the location and activity status of raptor nests in the area. Bald eagles have also been observed in the area (WGFD 1996b). Other raptor species that may occasionally be found in the J2PA include Swainson's hawk, merlin, peregrine falcon, and prairie falcon (WGFD 1992). Turkey vultures may scavenge in the area, and osprey may venture into the area from their habitat along the Green River.

3.3.2.4 Game Birds

The principal upland game bird found in the J2PA is sage grouse. Anderson (1996) conducted sage grouse lek surveys in much of the J2PA in the spring of 1996. An additional sage grouse lek survey of the J2PA and surrounding area will be conducted in 1997 by the WGFD to locate additional leks on the area. Seven active leks were observed, five of which were in Sand Draw (Map 3.6). One historic lek site was inactive, but was active in 1994 (BLM unpublished data). Upland Game Bird Management Area 7, in which the J2PA is located, has historically been one of the top sage grouse-producing areas in Wyoming.

The other game bird occurring in the J2PA is the mourning dove, a common summer resident that prefers open land with scattered vegetation and requires trees or some other type of structure for nesting. Doves that populate the J2PA likely utilize shrub-covered areas along washes and dunes that provide suitable cover for nesting and roosting.

3.3.2.5 Other Birds

Based on range and habitat preference (WGFD 1992; Dorn and Dorn 1990) and observation (Straley 1994; WGFD 1996b), 43 other bird species are likely to occur in the J2PA, including common raven, horned lark, lark bunting, loggerhead shrike, sage sparrow, sage thrasher, Brewer's sparrow, cliff swallow, barn swallow, mountain bluebird, western kingbird, grasshopper sparrow, killdeer, burrowing owl, common nighthawk, black-billed magpie, American crow, canyon wren, western meadowlark, Brewer's blackbird, common grackle, brown-headed cowbird, and mountain plover. Several species of wading/shore birds and waterfowl can occur around the small reservoirs in the J2PA. Wading/shore birds include black-necked stilt, willet, Wilson's phalarope, common snipe, great blue heron, snowy egret, long-billed dowitcher, and black-crowned night-heron. Waterfowl include pied-billed grebe, eared grebe, western grebe, green-winged teal, blue-winged teal, cinnamon teal, mallard, northern pintail, northern shoveler, gadwall, American wigeon, and ruddy duck.

3.3.2.6 Amphibians and Reptiles

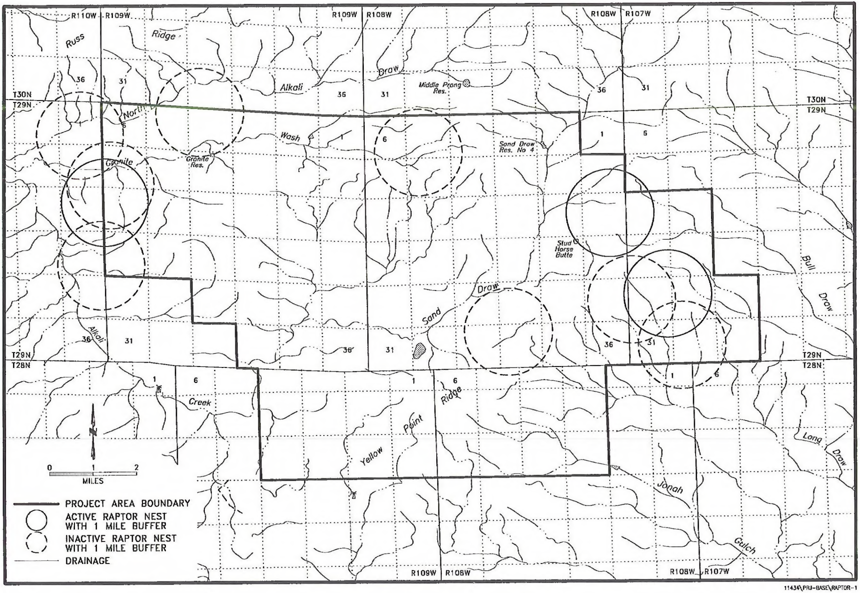
Based on range and habitat preference (Baxter and Stone 1985), two amphibian and four reptile species are likely to occur within the J2PA. Amphibians include the Great Basin spadefoot and the northern leopard frog, and reptiles include the northern sagebrush lizard, eastern short-horned lizard, bullsnake, and wandering garter snake.

3.3.2.7 Fisheries

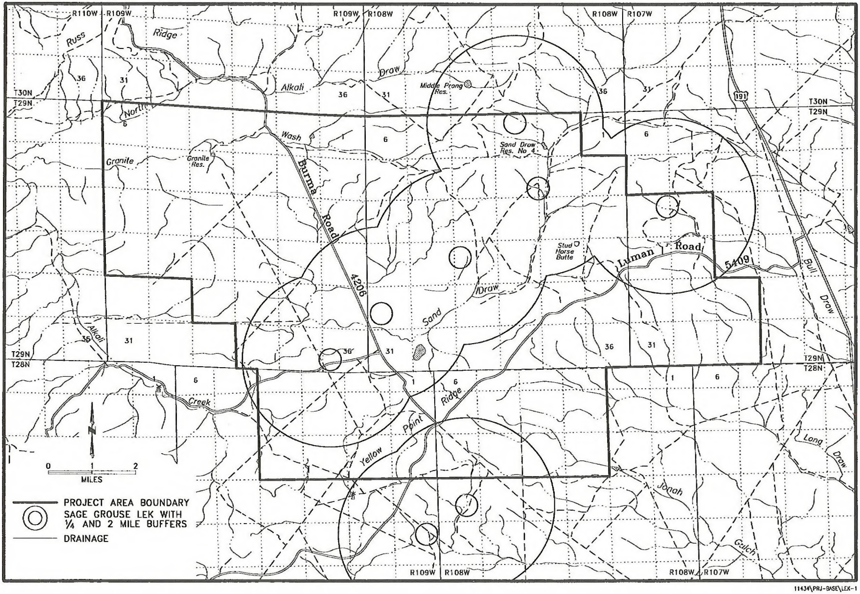
There are no perennial streams on the J2PA. The nearest perennial streams with significant fishery resources are the New Fork and Green Rivers, 4-8 mi west of the area.

3.3.3 Threatened, Endangered, and Special Status Species

A complete description of all potentially affected T&E and candidate species is provided in the BA for this project (see Appendix E).



Map 3.5 Raptor Nests, Jonah Field II Project, Sublette County, Wyoming.



Map 3.6 Sage Grouse Leks, Jonah Field II Project, Sublette County, Wyoming.

3.3.3.1 Plants

No federally listed T&E or candidate plant species are likely to be found in the J2PA; however, several SSPS have been reported from within or nearby the area (personal communication, June 1996, with Laura Gianakos, WYNDD, Laramie, Wyoming). These species include the Cedar Rim thistle (*Cirsium aridum*), tufted twinpod (*Physaria condensata*), Big Piney milkvetch (*Astragalus drabelliformis*), and large-fruited bladderpod (*Lesquerella macrocarpa*). The Cedar Rim thistle and large-fruited bladderpod are included on the BLM draft sensitive plant species list, and the BLM is committed to protect these species and their habitats from the need for formal protection, whenever possible. Of the four abovementioned species, only the Cedar Rim thistle has been reported from within the J2PA (Fertig 1993); however, no plants were found during a SSPS inventory of the area conducted in August 1996 (Intermountain Ecosystems LC 1996). In addition, Fertig (1994) surveyed five drillpads, their associated roads, and a 20-mi ROW for a proposed pipeline in and adjacent to the J2PA, and found no specimens of Cedar Rim thistle or Big Piney milkvetch.

3.3.3.2 Animals

T&E animals that could occur in the vicinity of the J2PA include black-footed ferret, bald eagle, peregrine falcon, and whooping crane. In addition, four endangered fish species--Colorado squawfish, humpback chub, bonytail chub, and razorback sucker--occur downstream of the J2PA in the Colorado and Green River drainages below Flaming Gorge Dam.

The last known wild ferret population was found near Meeteetse, Wyoming, in 1981, and a captive breeding program using ferrets from that population led to the introduction of individuals into Shirley Basin, Wyoming in 1992. The likelihood of the existence of a wild ferret population is considered very unlikely, but must still be considered possible. Black-footed ferrets depend on prairie dogs for both food and shelter and have never been found outside of prairie dog habitat.

No populations of bald eagles are known to occur in the J2PA; however, they do winter and migrate along the nearby Green River and have been observed in the Farson-Eden area.

Peregrine falcons use the Green River as a spring and fall migration corridor, and captive-raised birds have been released in the upper Green River Basin near Pinedale. However, the species does not nest in the J2PA due to a lack of suitable habitat.

Whooping cranes also use the Green River as a spring and fall migration corridor; however, no suitable foraging or nesting habitat occurs in the J2PA.

Mountain plover is the only candidate species (formerly federally listed as a Category 1 candidate species) likely to occur in the J2PA, and several USFWS species of concern (formerly federally listed as Category 2 candidate species) also have been reported from the area, including ferruginous hawk, western burrowing owl, pygmy rabbit, and eastern short-horned lizard. Other USFWS species of concern potentially occurring on the J2PA include three bat species--small-footed myotis, long-legged myotis, and Townsend's big-eared bat--and loggerhead shrike. Two fish species of concern--flannelmouth sucker and roundtail chub--do not occur in the area but are found in the Green River drainage approximately 6 mi west of the J2PA. Additional BLM-managed, USFWS species of concern and/or WGFD species of concern that may occur on or in the vicinity of the J2PA are listed in Appendix D.

3.3.4 Wild Horses

The small portion of the J2PA in the GRRA is included in the proposed Little Colorado Desert Interim Wild Horse Herd Management Area (WHHMA). The majority of the project area (i.e., that within the PRA) is not populated by wild horses. A fence delineating the boundary between the two resource areas restricts wild horse movement into the PRA. The portion of the J2PA within the WHHMA does not receive a high level of wild horse use due to the limited availability of water.

3.4 CULTURAL RESOURCES AND HISTORIC OVERVIEW

Additional detail on the cultural and historic resources of the J2PA and vicinity is provided in Appendix F.

3.4.1 Cultural Resources

Cultural resources, which are considered under the NHPA and the Archaeological Resources Protection

Act of 1979 (ARPA), are the nonrenewable remains of past human activity. The archaeological record of the J2PA has been partially examined through surveys, test excavations, examination of ethnographic materials (materials used to determine ethnic origin), consultation with modern Native American people, archival sources, and the historic record. Euro-American exploration and settlement in the area is understood by historic and archival records, by information provided by local ranchers, and by informant interview. The J2PA is rich in prehistoric resources (though they are poorly understood), but contains few historic period sites. The historic period sites predominantly relate to open range ranching, stock grazing, and wagon road passage.

3.4.1.1 Site Types

Prehistoric site types known or suspected for the J2PA include prehistoric campsites, house pits, lithic scatters, kill/butchering sites, floral processing locales, sacred sites, extensive lithic procurement locales, limited activity sites, various rock alignment sites, and Traditional Cultural Properties (TCPs). TCP is a term used in relation to sacred or respected places that have a current, dateable link to the present Native American population. Rock alignment sites include vision quest locales, stone circle sites such as tipi rings (three have been recorded), medicine wheels, and cairns. No drivelines are currently known, but they may be present on the J2PA. While no human burials, petroglyphs, or pictograph sites are presently known, the geomorphology of the area is conducive to the presence of these site types. The preliminary work conducted in the J2PA suggests high site density, complex geomorphology, and a different cultural character of the prehistory as compared to other, better known regions of the Green River Basin.

3.4.1.2 Native American Sensitive Sites and Traditional Cultural Properties

In the late nineteenth century, the J2PA was used predominantly by the Shoshone Tribe, though the Bannock, Ute, and other tribes frequented the Upper Green River. In prehistoric times, this picture is clouded, as tribal distinctions are difficult, if not impossible, to determine. Both prehistoric sites and more modern Native American use sites are sensitive, or can be considered TCPs.

Sites and properties within this class are protected by numerous laws, such as the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and executive orders. Human burials, rock alignment sites, petroglyphs, steatite procurement locales, and modern-day Native American use, extraction, or religious sites are considered sensitive or sacred to modern Native Americans. One such site is already identified on the J2PA, and others are known. Consultation with potentially affected Native American tribes concerning the identification and management of TCPs and other sensitive sites in the J2PA began in 1996, was curtailed by the onset of winter, and is scheduled to resume in the spring of 1997.

3.4.2 Historic Overview of the Upper Green River Region of Wyoming

3.4.2.1 Early Settlement

Beginning in the 1880s, the Rock Springs to New Fork Wagon Road carried freight, mail, and supplies to the inhabitants of the Upper Green River Basin (Vlcek 1995). This vital link (and its sister freight road, the Opal Wagon Road) carried virtually all of the imported goods and supplies to the inhabitants of what was to become Sublette County. The wagon road not only had a commercial function, but stops along the route served to give place names to an otherwise desolate landscape. Ten Tree, The Wells, Mud Hole, and Sand Springs became recognizable places, and Farson developed into a community. Because the Rock Springs to New Fork Wagon Road played a critical function in settling the region, it is recognized as a National Register of Historic Places (NRHP) eligible Expansion Era trail. Use of the wagon road continued until the paving of the Rock Springs to Pinedale Road in the 1920s (Gardner and Johnson 1991).

The exact location of the Rock Springs to New Fork Wagon Road in the vicinity of the J2PA is unknown; however, it is assumed to be on the eastern edge of the area, near U.S. Highway 191.

3.4.2.2 Agricultural Settlement

The livestock industry in the northern Green River Basin has shaped the image and influence of the region, its origins dating back to the 1870s and 1880s. The history of livestock associations in the region is

almost as old. Beginning with the creation of the Big Piney Roundup Association following the harsh winter of 1889-1890, the Upper Green River Cattle and Horse Association evolved to care for livestock as their numbers increased within the region. The current Upper Green River Cattle Association (UGRCA) has seasonally trailed or drifted cattle up and down the Green River since its creation in 1925 from the former association. Over the decades, this seasonal movement from one grazing range to another has become known as the Green River Drift. Cooperative activities of the UGRCA have evolved from simply caring for livestock herds during the seasonal drives to working with government agencies (e.g., USFS, BLM) in better managing the use of the land and protecting natural resources. UGRCA has had an important role in sustaining a viable ranching culture that has become a tradition in the Upper Green River Basin (Sommers 1994). Cattle grazed within the J2PA are some of the cattle in the Green River Drift.

3.4.2.3 Energy Resource Industries

Oil seeps and springs were probably known to exist by Native Americans in the Green River Basin (Veatch 1907); however, the extent and type of aboriginal use, if any, presently is not understood. It may be no coincidence that the historic California, Oregon, and Mormon Trails passed oil seeps to allow their utilization by the westbound immigrants (Metz 1986). Oil and gas reserves of commercial potential were discovered during the first decade of the twentieth century in the vicinity of LaBarge Creek, approximately 25 mi southwest of the J2PA. Studies of the surface geology resulted in the discovery of the current LaBarge Oil Field in 1924, which was part of the 1920s Wyoming oil boom (Espach and Nichols 1941; Wyoming Geological Association 1957; Biggs and Espach 1960).

3.5 SOCIOECONOMICS

The communities most likely to be impacted by the proposed project are Pinedale, Big Piney, Marbleton, and Boulder in Sublette County; LaBarge in Lincoln County; and Farson/Eden in Sweetwater County. Rock Springs (Sweetwater County) is about 70 mi from the project area, but is a hub of natural gas development activity and likely will be home to some of the workers.

3.5.1 Demography

3.5.1.1 Population Dynamics and Census Data

Wyoming's population increased from 332,416 to 469,557 (+41%) between 1970 and 1980, as people moved into the state seeking employment in mining, petroleum, and related industries. The increase in southwestern Wyoming was even greater than in the state as a whole, and populations in both Sublette and Sweetwater Counties generally followed the trend in southwestern Wyoming (University of Wyoming, Cooperative Extension Service, Agricultural Economics [UWCESAE] 1995). Falling mineral prices in the early 1980s slowed the influx of job-seekers and brought significant unemployment. By 1990, Wyoming's population had fallen to 453,588, 3.5% lower than the 1980 level (U.S. Department of Commerce, Economics and Statistics Administration, Bureau of the Census 1992); however, Wyoming's 1995 population estimate increased to 480,184, and the estimated population in 2000 is 498,020 (personal communication, October 1996, with Wenlin Liu, Wyoming Division of Economic Analysis).

Of the five counties (Carbon, Lincoln, Sublette, Sweetwater, and Uinta) comprising southwestern Wyoming, Sweetwater is the most populous (42.4%) and Sublette the least populous (5.3%) (UWCESAE 1995). The population in Sublette County was 3,755 in 1970 and has increased in each subsequent decade to 5,470 in 1995 and a projected 5,890 in 2000 (Table 3.6). Pinedale has also experienced constant growth--from 948 in 1970 to 1,336 in 1995 and a projected 1,439 in 2000. Big Piney, however, had a population of 570 in 1970 that declined to 454 in 1990 and grew to 514 in 1995. Growth to 553 is projected by 2000. Marbleton had a population of 223 in 1970, 537 in 1980, 634 in 1990, 727 in 1995, and is projected to grow to 783 by 2000. The 1990 population of Boulder was 189.

The population in Sweetwater County in 1980 was 41,723--up 127% from the 1970 population of 18,391; however, the population fell 7% to 38,823 by 1990. The 1995 population was 40,976, and the projected population in 2000 is 41,830--the approximate level of 1980. Rock Springs reflected the same general trends in population as did Sweetwater County, although the changes were less extreme. The 1970 population of 11,657 increased 67% to 19,458 in 1980, fell 2% to

Table 3.6 Population Estimates for the State of Wyoming, Sublette and Sweetwater Counties, and Selected Towns, Jonah Field II Project, Sublette County, Wyoming.

	Population				
Jurisdiction	1970	1980	1990	1995	2000
Wyoming	332,416	469,557	453,588	480,184	498,020
Sublette County	3,755	4,548	4,843	5,470	5,890
Sweetwater County	18,391	41,723	38,823	40,976	41,830
Pinedale	948	1,066	1,181	1,336	1,439
Marbleton	223	537	634	727	783
Big Piney	570	530	454	514	553
Rock Springs	11,657	19,458	19,050	20,144	20,624
LaBarge	--	302	493	527	551

19,050 in 1990, and increased 5% to 20,144 in 1995. The population in 2000 is projected to be 20,624.

The population of LaBarge in Lincoln County was 302 in 1980, 493 in 1990, 527 in 1995, and is projected to be 551 in 2000.

3.5.1.2 Economic Base and Employment

From 1975 to 1993, employment levels in southwestern Wyoming have increased 44% compared to 41% for the state of Wyoming (Table 3.7). Much of this growth occurred in Uinta County, where employment increased nearly 171% (UWCESAE 1995). Employment growth in Sublette and Sweetwater Counties was approximately 33% and 50%, respectively. During the same period, per capita income in southwestern Wyoming increased 177% compared to 210% for the state of Wyoming. Per capita income increased 154% in Sublette County and 168% in Sweetwater County.

Property valuations between 1980 and 1993 have increased 53% in southwestern Wyoming, compared to 36% in the state of Wyoming. Sublette County's valuation increased 148% and Sweetwater County's increased 42.6%. Personal property accounted for the largest increases in valuation.

Sublette County had a labor force of 3,020 in 1995, with an unemployment rate of 3.7% (personal communication, September 1996, with Gordon Wolford, Senior Statistician, Wyoming Department of Employment [WDOE]). Retail trade, services, and mining (including oil and gas) accounted for 26%, 23%, and 18%, respectively, of the average annual nongovernment employment in the county. Local government provided 72% of the government jobs in the county (WDOE 1996). Mining provided the highest average annual wage ($38,740), followed by federal government ($31,556), state government ($27,087), transportation and utilities ($25,707), and finance, insurance, and real estate ($23,375). Average annual wage in Sublette County in 1995 was $19,929 compared to the state average of $22,351.

Sweetwater County was buffered to some extent from recent economic declines. This was due primarily to trona mining and oil and gas exploration. Five companies refine soda ash from mined trona in the county, and several expansions are proposed or under construction. Modest growth is expected in the trona industry, and prices are expected to increase slightly

Table 3.7 Employment and Per Capita Income Increases, 1975-1993, Jonah Field II Project, Sublette County, Wyoming.[1]

Area	Employment Level Increase, 1975-1993 (%)	Per Capita Income Increase, 1975-1993 (%)
Wyoming	41	210
Southwestern Wyoming	44	177
Sublette County	33	154
Sweetwater County	50	168

1 Adapted from UWCESAE (1995).

over the next five years (Sweetwater County Economic Development Association 1992).

Sweetwater County's labor force in 1980 was 21,116, with an unemployment rate of 3.7%; in 1995, the number of persons in the labor force was 21,754, with an unemployment rate of 5.2% (personal communication, September 1996, with Gordon Wolford, Senior Statistician, WDOE). The mining industry employed the largest number of people in Sweetwater County (4,838) and paid the highest weekly wage ($961 per week) of any employer (WDOE 1996). Average annual wage in Sweetwater County during 1995 was $29,434, which was higher than the state average of $22,351.

3.5.1.3 Housing

Sublette County had 2,911 housing units in 1990, of which 1,281 (44%) were owner occupied, 553 (19%) were renter occupied, and 1,077 (37%) were unoccupied (personal communication, October 1996, with Wenlin Liu, Wyoming Division of Economic Analysis, Cheyenne) (Table 3.8). Pinedale had 661 housing units, of which 323 (49%) were owner occupied, 159 (24%) were renter occupied, and 179 (27%) were unoccupied. Big Piney had 219 housing units, of which 114 (52%) were owner occupied, 68 (31%) were renter occupied, and 37 (17%) were unoccupied. The 1990 census estimated 283 total housing units in Marbleton, with 150 (53%) owner occupied, 79 (28%) renter occupied, and the remaining 54 (19%) unoccupied. Recent information indicates that abundant commercial property is available for purchase in Big Piney/Marbleton (Sublette County Journal [SCJ] 1996a). The general vicinity around Boulder had 118 housing units in 1990--46 (39%) were owner occupied, 19 (16%) renter occupied, and 53 (45%) unoccupied (the habitability of these unoccupied housing units is unknown). LaBarge had 217 housing units in 1990, of which 125 (58%) were owner occupied, 40 (18%) were renter occupied, and 52 (24%) were unoccupied.

Sweetwater County had 15,444 year-round housing units in 1990, with a vacancy rate of 12% (1,828 vacant units). The vacancy rate for year-round rental units was 14%, whereas the owner-occupied vacancy rate was 3%. Of 13,616 occupied units in the county, 70% were owner occupied and 30% were renter occupied. A report issued by the Sweetwater County Economic Development Association Affordable Housing Task Force (Planning Information Corporation [PIC] 1995) lists 7,661 total housing units in the City of Rock Springs. Of these, 5,036 are single family dwellings, 1,462 are mobile homes, and 1,163 are multi-family housing units. In December 1994, 86 homes were for sale in Rock Springs, representing 1.7% of the single family dwellings in the city. Of the 7,661 housing units, 3,536 (46%) are rentals with a vacancy rate of 2.1%. Two hundred fifty-three (17%) of the 1,512 mobile home pads in Rock Springs are unoccupied (PIC 1995). An addendum (PIC 1996) to the PIC (1995) report concluded that: the existing shortage of available housing is expected to worsen, especially after 1997; a

Table 3.8 1990 Housing Units in Areas Potentially Affected by the Jonah Field II Project, Sublette County, Wyoming.

	No. of Housing Units (Percentages in Parentheses)			
Area[1]	Total Units	Owner Occupied	Renter Occupied	Unoccupied
Sweetwater County	15,444	9,531 (62)	4,085 (26)	1,828 (12)
Sublette County	2,911	1,281 (44)	553 (19)	1,077 (37)
Pinedale	661	323 (49)	159 (24)	179 (27)
Big Piney	219	114 (52)	68 (31)	37 (17)
Marbleton	283	150 (53)	79 (28)	54 (19)
LaBarge	217	125 (58)	40 (18)	52 (24)
Boulder	118	46 (39)	19 (16)	53 (45)

[1] Data from Wenlin Liu, Wyoming Division of Economic Analysis, Cheyenne.

substantial increase in demand for housing without a commensurate increase in the supply of available housing will drive up purchase and rental prices; a sustained shortage of available housing may cause a redirection of population growth to unincorporated areas of the county or smaller communities; and future demand for housing is expected to be sufficient to justify and encourage development of additional single family homes and multi-family rental units. Numerous additional single family homes have been constructed in the Rock Springs/Green River area since 1994.

3.5.1.4 Social Traditions

A history of the upper Green River Basin settlement is presented in Section 3.4.2. The area was first explored by fur trappers, who were followed by cattle and sheep ranchers. The discovery of oil and gas provided the resource base for increased settlement in the Basin, and the development of irrigation benefited agriculture. The vicinity of the proposed project traditionally and currently is rural in nature, relying primarily on extractive uses, livestock, and agriculture. The Town of LaBarge emerged as a result of the oil and gas industry.

3.5.2 Infrastructure

The Wyoming Department of Commerce (WDOC) publishes community profiles for towns throughout the state. The following descriptions of Pinedale, Big Piney, LaBarge, and Rock Springs were based on information presented in community profiles (WDOC 1993). The descriptions of Eden/Farson and Boulder are based on information supplied by BLM (1995c) and personal communications (personal communication, October 1996, with Wenlin Liu, Wyoming Division of Economic Analysis; personal communication, October 1996, with Donna Steele, owner, the Boulder Store). Data on Marbleton are from the Marbleton Chamber of Commerce.

Pinedale. Located approximately 100 mi northwest of Rock Springs and 32 mi north of the J2PA on U.S. Highway 191, Pinedale is the county seat of Sublette County. Pinedale's population was 1,336 in 1995 (see Table 3.6). The town has a mayor/council government, 911 emergency service, and a volunteer fire department. Police protection for the town is provided through contract with the Sublette County Sheriff's Office. There is a 37,000-volume library, one day care center, one senior center, nine churches, 11

hotels/motels with a total of 162 rooms, and a recreational vehicle (RV) park with 44 spaces. Medical services include two doctors, a physician's assistant, and one dentist, ambulance service, and a nursing home with 107 rooms. Communications include a weekly newspaper, cable TV, and a post office. There is one golf course, one ice skating rink, bike paths, and two parks, as well as a small airport. Services, mining (including oil and gas production), and retail trade employ the most people. Mining paid the highest wage.

Big Piney. Big Piney is located on U.S. Highway 189 about 95 mi north of Green River and 35 mi southwest of Pinedale. Big Piney's population was 514 in 1995 (see Table 3.6). The town has a mayor/council government, 911 emergency service, and a voluntary fire department. Police protection is provided by the Sublette County Sheriff's Office. There is a 40,000-volume library, one day care center, six churches, and three motels with a total of 25 rooms. Medical services include two doctors, one dentist, and ambulance service. Communications include a weekly newspaper, cable TV, and a post office. There is one ice skating rink, one bike path, three parks, three baseball fields, one swimming pool, and a small airport. Major employers include the oil and gas industry, agriculture, and retail trade and services.

Marbleton. Marbleton is located on U.S. Highway 189 1 mi north of Big Piney. The town's population was 727 in 1995 (see Table 3.6). Marbleton has an RV park and picnic grounds, two motels, a coffee shop and restaurant, gas stations, retail shops, a movie theater, a medical clinic, and an airport. Major industries include ranching, oil and gas, and recreation.

Boulder. Boulder is an unincorporated community located on U.S. Highway 191 12 mi south of Pinedale and 85 mi north of Rock Springs. Boulder has a post office and the Boulder Store, which includes a store, gas station, RV park (9 spaces), motel (9 rooms), restaurant, and bar.

LaBarge. LaBarge, incorporated in 1973, is located in Lincoln County on U.S. Highway 189 approximately 75 mi north of Green River and 21 mi south of Big Piney. LaBarge's population was 527 in 1995 (see Table 3.6). The town has a mayor/council, one full-time and one part-time policeman, 911 emergency telephone service, a 15-member volunteer fire department, and an assessed valuation of $1,161,279. There is a 6,000-volume library, one day care center, one senior center, four churches, one motel with 36 rooms, and an RV park with six spaces. Medical services are provided by a weekly clinic and by ambulance service, and communications include a weekly newspaper, cable TV, and a post office. Recreational facilities include one ice skating rink, two baseball fields, bike paths, two parks, and a small airport. Services, mining (including oil and gas production), and retail trade employ the most people. Mining paid the highest wage.

Eden/Farson. Eden/Farson is an unincorporated community of approximately 500 people located on U.S. Highway 191 about 40 mi northwest of Rock Springs and 28 mi southeast of the J2PA. The agriculture and mining industries are the primary employers. The community is governed by Sweetwater County, has a resident sheriff's officer and highway patrolman, a 26-member volunteer fire department, ambulance service, and 911 emergency phone service. There are four churches, two gas stations, two cafes, two bars, and a convenience store. Recreational facilities include a youth center and a county park.

Eden/Farson is not serviced by a doctor, nurse, or dentist, although there is an emergency medical technician service. The nearest medical facility is in Rock Springs. There is one elementary and one secondary school. Bridger Valley Electric supplies energy and three vendors supply propane for heating. Residents have individual wells and septic systems, and solid waste disposal facilities are available. Housing is limited, with ranch homes the primary type of housing.

Rock Springs. Rock Springs is located along I-80 in west-central Sweetwater County and serves as the economic hub of the area. Law enforcement and fire protection services are available, as well as a 911 emergency number. A City Planning Commission administers zoning regulations and building codes and approves industrial plans. Public education is provided by 11 elementary schools, two junior high schools, and one high school. Western Wyoming Community College is also located in the city. Community services consist of two libraries (107,000 total volumes), eight day care centers, and 32 churches. Commercial services include two shopping

centers, five convention facilities (with a total capacity of 4,660 persons), 25 hotels and motels (1,400 total rooms), an RV park (50 spaces), and several mobile home parks. Medical care is provided by a hospital (100 beds), a nursing home (100 rooms), 33 doctors, 24 dentists, and an ambulance service. Communications consist of two local newspapers (one published in Rock Springs and one in Green River), cable TV, US West telephone service, reception of two AM and three FM radio stations, and two post offices.

Recreation resources include 17 baseball fields, 24 tennis courts, six swimming pools, eight soccer fields, a golf course, one ice skating rink, two recreation centers, and 24 parks. Outdoor recreation opportunities available within 30 mi of the city include Flaming Gorge National Recreation Area and various opportunities on BLM-administered lands, including Boar's Tusk, sand dunes, petroglyphs, and the Oregon/California Trails. Cultural/entertainment attractions include the Red Desert Rodeo, the Sweetwater County Museum, the historical Rock Springs City Hall Museum, the Fine Arts Center, and the Western Wyoming Community College Dinosaur Collection.

Major employers are FMC Wyoming Corporation; General Chemical; OCI Wyoming, L.P.; Bridger Power; Solvay Minerals; and Black Butte Coal. The mining industry employs 27% of the Rock Springs work force.

A wastewater treatment plant built in the late 1980s contains excess capacity, and a new district with excess capacity recently has been formed for solid waste. Rock Springs has been on summer water rationing for the past several years because of an inadequate water treatment system, but a new water treatment plant currently is being planned and is expected to be on-line in late 1998 (personal communication, March 1995, with Deanna Holloway, Administrative Assistant, Green River/Rock Springs Joint Powers Water Board).

3.5.3 Local Government Revenues

Sublette County had an assessed valuation of $262,350,711 in 1995 (Wyoming Department of Revenue [WDOR] 1995) and $216,400,442 in 1996 (SCJ 1996b)--the seventh highest assessed valuation of the 23 counties in Wyoming (Table 3.9). The assessed valuation of Pinedale in 1995 was $6,437,724, whereas Big Piney's assessed valuation was $1,360,398 and Marbleton's was $1,845,079 (WDOR 1995). The market value of property in Sublette County in 1996 was $970,273,204. In 1996, 59.7% of taxes came from minerals, and 76.6% of tax collections went to schools. The assessed valuation of natural gas production in Sublette County in 1995 was $161,886,490--second highest of any county in Wyoming; however, the county was last in sales and use tax collections, with $2,539,175 (WDOR 1995). Total county taxes were $17,005,871--ninth highest of any county in Wyoming. Federal royalties on mineral production in Sublette County totalled nearly $27.5 million ($21.5 million of which was from natural gas production), half of which was returned to the state of Wyoming. In 1995, the state's share of federal mineral royalty revenues was distributed among the Wyoming School Foundation Program (40.0%); the Highway Fund (23.4%); Capital Construction for Cities, Towns, Counties, and Special Districts (9.8%); Cities and Towns (8.4%); the University of Wyoming (6.0%); the Legislative Royalty Impact Account (4.3%); the Highway Fund for County Roads, and State Aid to County Roads (4.0%); School Districts Capital Construction (2.4%); and other accounts (1.7%) (BLM 1997b).

Of the $188,388,943 collected in mineral severance taxes in Wyoming in 1995, $16,966,251 was returned to cities, towns and counties (WDOR 1995). Sublette County received $52,881, Pinedale $39,998, Big Piney $15,376, and Marbleton $21,472. The State of Wyoming returns a portion of its share of federal mineral royalties to cities and towns, and in 1995, returned $125,227 to Pinedale, $57,374 to Big Piney, and $74,174 to Marbleton. City/town taxes collected in 1995 totaled $1,128,088 in Pinedale, $100,056 in Big Piney, and $149,154 in Marbleton. Sublette County received $418,160 in sales/use tax monies from the State in 1995, whereas Pinedale received $191,889, Big Piney received $73,719, and Marbleton received $102,986 (WDOR 1995). Federal land payments (federal revenue sharing payments and payment-in-lieu-of-taxes) to Sublette County in 1993/1994 were $388,206 (UWCESAE 1995).

Sweetwater County had an assessed valuation of $1,024,102,302 in 1995 (WDOR 1995)--the second highest assessed valuation of the 23 counties in Wyoming. The assessed valuation of natural gas production in Sweetwater County in 1995 was $268,797,960--highest of any county in Wyoming. The

Table 3.9 Some Economic Statistics for Local Governments in Areas Potentially Affected by the Jonah Field II Project, Sublette County, Wyoming.[1]

Area	Assessed Valuation: Total	Assessed Valuation: Natural Gas Production	Federal Royalties on Mineral Production in County	Total County Taxes Collected	State's Share of Federal Mineral Royalties Returned to Cities/Towns	Federal Revenue Sharing Payments in Lieu of Taxes Paid to Counties	County Sales and Use Tax Collections	City/Town Taxes Collected	State Sales/Use Taxes Returned to Counties/Towns	State Mineral Severence Taxes Returned to Counties/Towns
Sweetwater County	$1,024,102,302	$268,797,960	$65.8 million	$71,328,212	N/A	$912,215	$37,221,861	N/A	$2,577,431	$354,979
Sublette County	$216,400,442	$161,886,490	$27.5 million	$17,005,871	N/A	$388,206	$2,539,175	N/A	$418,160	$52,881
Pinedale	$6,437,724	N/A	--	--	$125,227	N/A	N/A	$1,128,088	$191,889	$39,998
Big Piney	$1,360,398	N/A	--	--	$57,374	N/A	N/A	$100,056	$73,719	$15,376
Marbleton	$1,845,079	N/A	--	--	$74,174	N/A	N/A	$149,154	$102,986	$21,472
Rock Springs	$59,392,609	N/A	--	--	$932,106	N/A	N/A	$4,372,544	$7,924,466	$645,187
LaBarge	$2,583,575	N/A	--	--	$59,344	N/A	N/A	$190,867	$110,278	$16,697

[1] Taken from Sublette County Journal (1996b); University of Wyoming, Cooperative Extension Service, Agricultural Economics (1995); and Wyoming Department of Revenue (1995).

county was fourth in sales and use tax collections, with $37,221,861, and second in total county taxes with $71,328,212. Federal royalties on mineral production in Sweetwater County totaled nearly $65.8 million ($27.9 million of which was from natural gas production), half of which was returned to the State of Wyoming. The assessed valuation of Rock Springs in 1995 was $59,392,609 (WDOR 1995).

Sweetwater County received $354,979 in 1995 from the portion of mineral severance taxes returned to cities, towns and counties, and Rock Springs received $645,187 (WDOR 1995). The State of Wyoming returned $932,106 to Rock Springs as its portion of the State's 50% share of 1995 federal mineral royalties. City taxes collected in Rock Springs in 1995 totaled $4,372,544. Sweetwater County received $2,577,431 in sales/use tax monies from the State in 1995, and Rock Springs received $7,924,466 (WDOR 1995). Federal land payments (federal revenue sharing payments and payment-in-lieu-of-taxes) to Sweetwater County in 1993/1994 were $912,250 (UWCESAE 1995). Sweetwater County also received $1,068,662 in impact assistance tax refunds for major projects from the State General Fund.

LaBarge (Lincoln County) had an assessed valuation of $2,583,575 in 1995 (WDOR 1995), received $16,697 from the portion of mineral severance taxes returned to cities, towns and counties, and $59,344 from the State's 50% share of federal mineral royalties. City taxes collected in LaBarge in 1995 totaled $190,867, and the town received $110,278 in sales/use tax monies from the State (WDOR 1995).

3.5.4 Environmental Justice

Executive Order 12898 directs BLM to assess whether the Proposed Action or alternatives would have disproportionately high and adverse human health or environmental impacts on minority and low-income populations. Identification of environmental issues is accomplished through public involvement and the scoping process. Native American tribes potentially affected by the project have been contacted by BLM and invited to comment on the Proposed Action and alternatives. Subsequent to a meeting held in March 1997 between the BLM and a representative from the Wind River Indian Reservation, the BLM determined that issues associated with environmental justice would not be affected by the project; therefore, they are not discussed further in this EIS. Coordination with the Wind River Environmental Commission will continue, especially regarding air quality issues.

3.6 LAND USE

3.6.1 Status/Use

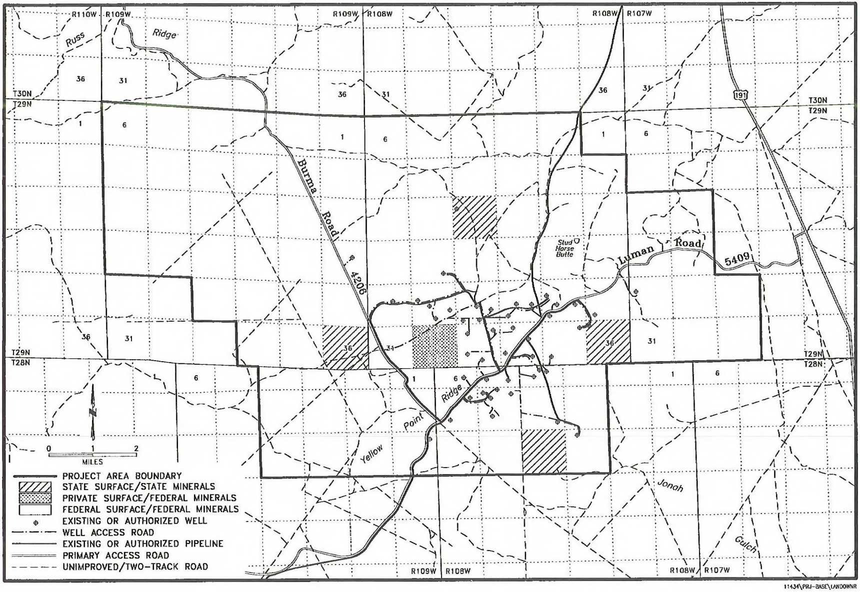
The J2PA consists of federal surface/federal minerals administered by the BLM, with the exception of four sections (2,560 acres) of State of Wyoming surface/minerals and one section (640 acres) of private surface/federal minerals (Map 3.7). Sublette County has zoned the area for Resource Conservation which allows for land uses including grazing, agriculture, and energy production (personal communication, August 21, 1996, with Misty Haehn, Sublette County Planner, Pinedale). Current land use includes livestock grazing, natural gas production, wildlife habitat, and recreation--primarily hunting. Map 3.7 shows all existing and/or authorized natural gas wells (49), improved and unimproved roads, and pipelines on the J2PA.

3.6.2 Livestock/Grazing Management

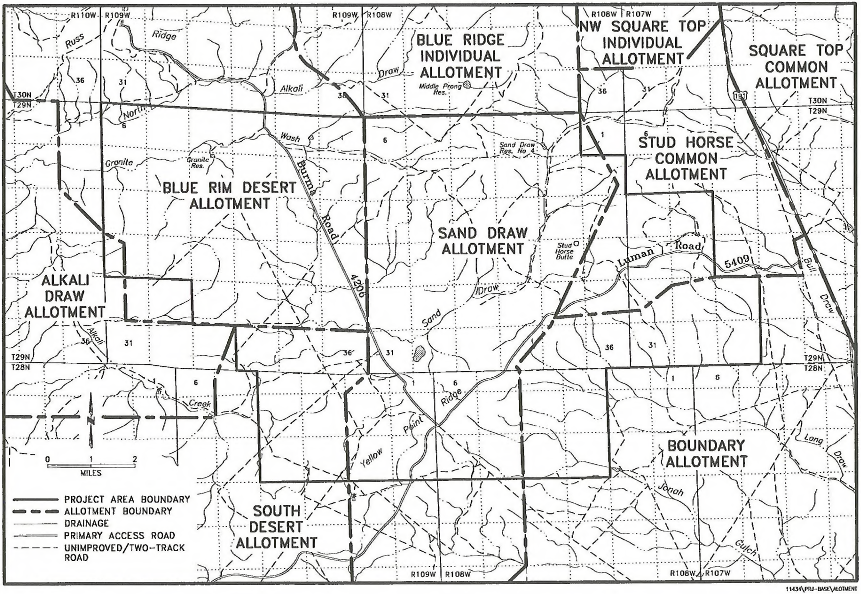
The J2PA includes portions of six grazing allotments--Stud Horse Common, Sand Draw, Blue Rim Desert, Alkali Draw, South Desert, and Boundary (Map 3.8). The Stud Horse Common allotment includes 14,175 acres of BLM lands providing 2,173 animal unit months (AUMs) (the amount of forage to sustain one cow and calf for one month), and 1,280 acres of state lands providing 213 AUMs--an average of 6.5 acres/AUM. Cattle are grazed from May 1 to June 30. The J2PA includes approximately 4,500 acres of the Stud Horse Common allotment providing 692 AUMs.

The Sand Draw allotment includes 30,687 acres of BLM lands providing 2,324 AUMs (13.2 acres/AUM) and 1,280 acres of state lands. Cattle are grazed in the spring, and sheep in the fall. The J2PA includes approximately 25,500 acres of the Sand Draw allotment providing 1,932 AUMs.

The South Desert allotment includes 32,813 acres of BLM lands providing 2,631 AUMs (12.5 acres/AUM) and 1,280 acres of state lands. Cattle are grazed in the spring and summer, and sheep in the fall. The J2PA includes approximately 4,900 acres of the South Desert allotment providing 392 AUMs.



Map 3.7 Land/Mineral Ownership, Jonah Field II Project, Sublette County, Wyoming, 1997.



Map 3.8 Grazing Allotments, Jonah Field II Project, Sublette County, Wyoming, 1997.

The Blue Rim Desert allotment includes 40,378 acres of BLM lands providing 2,826 AUMs (14.3 acres/AUM), 947 acres of state lands, and 598 acres of private lands. Cattle are grazed in the spring. The J2PA includes approximately 16,300 acres of the Blue Rim Desert allotment providing 1,140 AUMs.

The Alkali Draw allotment includes 23,361 acres of BLM lands providing 1,556 AUMs (15.0 acres/AUM), 1,280 acres of state lands, and 108 acres of private lands. Cattle are grazed in the spring and fall. The J2PA includes approximately 300 acres of the Alkali Draw allotment providing 20 AUMs.

The Boundary allotment includes 29,995 acres of BLM lands providing 2,996 AUMs (10.0 acres/AUM), with a 5-year average utilization of 1,604 AUMs (BLM 1996a). The allotment is managed for three-pasture deferred rotation/short duration, low intensity grazing, and although approved for yearlong grazing, it is not used yearlong. Grazing management is satisfactory and the overall apparent trend is static. Cattle and sheep are grazed from May-November (BLM 1994b). The J2PA includes approximately 8,100 acres of the Boundary allotment providing 810 AUMs. Lambing occurs in the portion of the allotment in the J2PA from May 15 to June 15, and the lambing process can be disturbed by activities such as construction and drilling and associated traffic.

3.6.3 Recreation

Davis-Peterson Associates, Inc. (1995) estimate that total traveler expenditures in southwestern Wyoming (Carbon, Lincoln, Sublette, Sweetwater, and Uinta Counties) were $282 million in 1994, with Sweetwater County having the most ($98 million) and Sublette County the least ($30 million). Vacationers represented 55% of total traveler expenditures in the five-county region. Data suggest that travel peaked in 1981, declined until 1988, and has been growing steadily through 1993 (UWCESAE 1995). Southwestern Wyoming is an important recreation area for Wyoming residents. The 1990 Wyoming State Comprehensive Outdoor Recreation Plan (SCORP) (State of Wyoming 1990) reports that southwestern Wyoming, with 20% of the state's population, supports more than 50% of all Wyoming resident ORV and four-wheel drive use, 49% of all resident antelope hunting, 36% of all resident elk hunting, 15% of all resident sightseeing, 16% of all resident cross-country skiing, and 17% of all historical site visits and day hiking. Relative to its population (1.1% of state), Sublette County was especially important in terms of ORVs (21.6%), antelope hunting (15.6%), elk hunting (17.5%), snowmobiling (16.3%), backpacking (18.7%), and camping (11.9%).

The 1990 SCORP also reported that participation rates in outdoor recreation were higher in southwestern Wyoming (22.9%) than in Wyoming as a whole (19.4%), and Sublette and Sweetwater County residents had participation rates of 23.2% and 23.6%, respectively. Fishing, deer hunting, elk hunting, sightseeing, and picnicking were the five most popular activities in Sublette County, and fishing, deer hunting, camping, sightseeing, and antelope hunting the five most popular in Sweetwater County.

Other than hunting, little recreational activity occurs in the J2PA. A limited amount of sightseeing and ORV use probably occurs; the area is designated as suitable for ORV use in the PRA RMP. In 1995, 292 hunters spent approximately 800 days to take 267 antelope for a 91.4% success rate in Antelope Hunt Area #90--the Hunt Area that includes the J2PA (WGFD 1996a). The WGFD (1996c) indicates that antelope hunters spent approximately $183.29/day to hunt antelope in the area, resulting in a total of approximately $146,632 in total expenditures for Hunt Area #90. From 1990 to 1994, numbers of hunters ranged from 242 to 1,070; harvests from 218 to 1,500; days hunted from 562 to 3,362; and success rates from 90 to 160%.

In 1995, 757 sportsmen hunted sage grouse for 2,303 days and harvested 2,446 birds (1.1 birds/day) in Upland Game Bird Management Area 7--the area in which the J2PA is located (personal communication, September 1996, with Doug McWhirter, Wildlife Biologist, WGFD, Pinedale). The WGFD (1996c) estimates sage grouse hunters spent approximately $138.04/day to hunt sage grouse in the area, resulting in a total expenditure of approximately $317,906. Upland Game Bird Management Area 7 is quite large, extending from Rock Springs to north of Pinedale, and generally from the Continental Divide west to the Green River. There has been a rather steady decline in the number of sage grouse hunters, days hunted, and number harvested since 1990. From 1990 to 1994, numbers of hunters ranged from 1,190 to 2,023; harvests from 4,128 to 8,176; days hunted from 3,274 to 5,400; and birds/day from 1.3 to 1.7.

Between 1990 and 1995, Area 7 had either the greatest or second greatest number of sage grouse hunters, hunting effort, and birds harvested of the 45 Upland Game Bird Management Areas in Wyoming.

In 1995, 193 hunters spent 1,506 days to take 986 cottontails (0.7 cottontails/day) in Small Game Management Area 7 (the boundaries for Small Game Management Area 7 are the same as for Upland Game Bird Management Area 7). Approximately $274,604 were spent to hunt cottontails in the area ($182.34/day for 1,506 days [WGFD 1996c]). As with sage grouse, this reflects a decline since 1990, especially in the number of hunters and the hunting effort. From 1990 to 1994, numbers of cottontail hunters ranged from 320 to 1,245; harvests from 820 to 20,636; days hunted from 2,055 to 4,497; and cottontails/day from 0.3 to 4.0. Area 7 had the second greatest number of cottontail hunters and hunting effort, and the first to eleventh highest harvest during 1990-1995 period of the 45 hunt areas in Wyoming.

While no wilderness or wilderness study areas occur in the J2PA, the Bridger Wilderness is present approximately 20 mi northeast of the area. The Bridger Wilderness and adjacent Fitzpatrick Wilderness provide regional opportunities for remote recreational activities.

3.7 VISUAL RESOURCES

The entire J2PA is in a Class IV visual resource management (VRM) classification area. Class IV designation provides for management activities that may generate major modifications of the existing character of the landscape. Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, and texture) inherent in the characteristic landscape. A Class IV VRM designation allows for modification of the landscape to accommodate natural gas production, but advocates that surface facilities be painted to blend with the surroundings and lessen the visual impacts.

A VRM Class III area occurs as a 1-mi corridor surrounding U.S. Highway 191 just east of the J2PA. A Class III designation provides for moderate changes to the existing landscape, although management activities associated with these changes should not dominate the view of the casual observer. For the most part, the J2PA is not visible from U.S. Highway 191, a major corridor for tourists. The only currently identified project feature present in the VRM Class III corridor is the Luman Road.

3.8 HAZARDOUS MATERIALS

Hazardous substances present in the EIS area include those used and produced in association with natural gas drilling, completion, and production as listed in Section 2.4.10 and BLM (1994b). These substances are discussed in further detail in the Hazardous Materials Summary for this project (Appendix C).

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATIONS

The potential environmental impacts resulting from the construction, drilling, completion, operations, and maintenance of the proposed project are discussed for each affected resource for the Proposed Action and each alternative. An environmental impact is defined as a change in the quality or quantity of a given resource due to a modification in the existing environment resulting from project-related activities. Impacts can be beneficial or adverse, can be a primary result of an action (direct) or a secondary result (indirect), and can be permanent or long-lasting (long-term--more than 5 years) or temporary and of short duration (short-term--5 years or less). Impacts can vary in degree from a slightly discernable change to a total change in the environment.

Potential impacts for this project were quantified where practical. In accordance with CEQ regulation 40 CFR 1052.16, this chapter includes a discussion of the direct and indirect effects of the Proposed Action and Alternatives A and B and their significance. Possible conflicts between the Proposed Action and alternatives and the objectives of the BLM RMPs and state and local land use plans and policies are identified, as are means to mitigate adverse environmental impacts, if not covered by applicant-committed measures. The use of adjectives such as moderate, low, and negligible have been avoided because this EIS is an analytical document, not a decision document (BLM 1996c). The ROD for this project will be the decision document.

Each resource discussed in this chapter includes a description of the following.

- Management objectives. Management objectives, as defined in the PRA and GRRA RMPs (BLM 1987b, 1996a), the WSLUC (1979), and the Sublette County Land Use Plan (SCBC 1978), are defined for each resource, and the Proposed Action and Alternatives are assessed for compatibility with these objectives, as well as for significance of impacts.

- Impacts. The level and duration of impacts that would occur as a result of the Proposed Action, Alternative A, Alternative B, and the No Action Alternative are described, and it is assumed that applicant-committed practices as described in Chapter 2.0, as well as those described in Appendices A, B, C, D, and E, would be implemented to minimize adverse impacts.

- Mitigation. Mitigation measures, in addition to those described in Chapter 2.0 and Appendices, that could be applied to avoid or further reduce adverse impacts are identified.

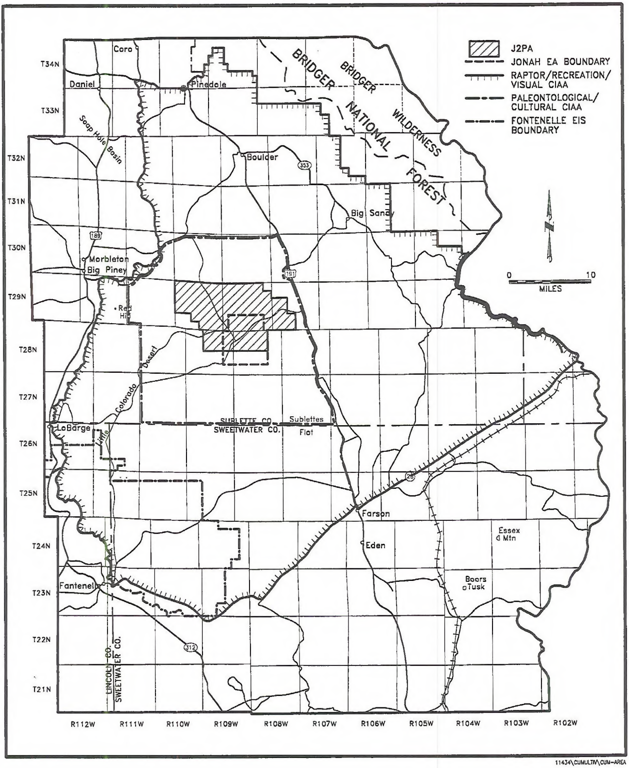
- Cumulative Impacts. Cumulative impacts are those which result from the incremental impacts of an action added to other past, present, and reasonably foreseeable actions, regardless of who is responsible for such actions. These impacts are described for each potentially affected resource. Cumulative impact assessment areas (CIAAs) vary depending on the resource. Table 4.1 lists the CIAAs for each of the resources, and Map 4.1 depicts the location of selected CIAAs.

Existing surface disturbance in the J2PA and CIAAs was estimated using 1983 BLM 1:24,000 scale color aerial photographs; 1986 and 1993 county road maps for Sweetwater and Sublette Counties, respectively; U.S. Geological Survey (USGS) and BLM maps of the areas; and a 1996 Operator map of the region depicting the location and status of oil and gas wells. All visible disturbances on the aerial photographs, as well as those depicted on maps, were quantified, including residential areas, borrow pits, well pads and associated disturbances, impoundments, and roads. Roads were classified as two-tracks (8 ft width of disturbance), resource roads (24 ft width of disturbance), local roads (32 ft width of disturbance), collector roads (36 ft width of disturbance), and highways (100 ft width of disturbance). Because pipelines often were difficult to distinguish from unimproved roads on the aerial photographs, they were classified using the same width categories as roads. Large tracts of agricultural lands and hay fields--primarily along the Green and New Fork Rivers--were also quantified; however, due to the scattered distribution and the difficulty in identifying

Table 4.1 Cumulative Impact Assessment Areas, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.

Resource	CIAA[1]
Air quality	Project area and Class I airsheds at Bridger/Fitzpatrick Wilderness for air quality-related values
Topography/physiography	Project-affected watersheds
Geology	
Mineral resources	Combined Jonah II and Jonah EA project areas
Geologic hazards	Combined Jonah II and Jonah EA project areas
Paleontological resources	Paleontological/cultural resource CIAA
Soils	Project-affected watersheds
Water resources	
Surface water	Project-affected watersheds
Groundwater	Project area
Noise and odor	Project area and 2-mi buffer
Vegetation	
General	Project-affected watersheds
Wetlands/riparian areas	Project-affected watersheds
Wildlife and fisheries	
Big game	Spring/summer/fall range and migration corridors for the Sublette Pronghorn Antelope Herd
Sage grouse	Upland Game Bird Management Area 7
Raptors	Raptor/recreation/visual resource CIAA
Fisheries	Project-affected watersheds
Other species	Project area and 2-mi buffer
Wild horses	Project-affected Herd Management Areas
Threatened, endangered, candidate, and state sensitive species	Entire ranges for affected species
Cultural resources	Paleontological/cultural resource CIAA
Socioeconomics	Sublette County and affected communities
Land use	
Agricultural/rangeland	Project-affected grazing allotments
Minerals extraction	Combined Jonah II and Jonah EA project areas
Recreation	Raptor/recreation/visual resource CIAA
Land status and prior rights	Project area
Visual resources	Raptor/recreation/visual resource CIAA

[1] CIAA = Cumulative Impact Assessment Area; see Maps 4.1 and 4.2 for locations.



Map 4.1 Cumulative Impact Assessment Areas for Cultural, Paleontological, Recreational, and Visual Resources and Raptors, Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

smaller tracts of such lands, numbers for this category of disturbance were underestimated. The 1996 oil and gas well location map, county road maps, and USGS and other BLM maps were used to update and supplement information obtained from the aerial photographs. All wells which were drilled after 1983 and are still producing were assumed to disturb 0.7 acre/well plus the disturbance resulting from the access road. Wells present on the 1983 photos that have since been reclaimed or are no longer producing were not included in the estimated acreage of disturbance.

Reasonably foreseeable development (RFD) in the CIAAs is defined in this document as including the proposed development described in the Fontenelle EIS/ROD (BLM 1996d), if applicable, and an additional four exploratory wells drilled per year, two of which are assumed to be successful within the 2,420-mi raptor/recreation/visual resource CIAA (see Map 4.1) (i.e., an estimated 0.023 acres of disturbance per mi^2 for the LOP). However, it is acknowledged that future development will depend to a large extent on the price of natural gas, which cannot be predicted. If gas prices rise, it is likely that more exploration and development would occur.

- Unavoidable Adverse Impacts. Unavoidable adverse impacts are impacts that cannot be avoided nor completely mitigated.

Irreversible and irretrievable commitment of resources and short-term use of the environment versus long-term productivity are discussed in Sections 4.8 and 4.9, respectively. Irreversible and irretrievable impacts are permanent reductions or losses of resources that, once lost, cannot be regained. In comparing short-term use of the environment versus long-term productivity, short-term use of the environment occurs during the LOP, and long-term productivity refers to the period after the project is completed and the area is reclaimed.

4.1 PHYSICAL RESOURCES

4.1.1 Air Quality

The air quality management objective prescribed in the PRA and GRRA RMPs (BLM 1987b, 1996a), State (WSLUC 1979), and local (SCBC 1978) land use plans is to maintain or improve the quality of air resources in Wyoming. The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, although there is a potential for direct and cumulative visibility impacts to exceed the USFS's "Limit of Acceptable Change" within the PSD Class I Bridger Wilderness Area.

The air quality impact assessment is based on the best available engineering data and assumptions, meteorology data, and EPA dispersion modeling procedures. However, where specific data or procedures were not available, conservative "worst case" assumptions were incorporated. For example, the air quality impact assessment assumed that all 450 natural gas wells would go into production (no "dry holes") within 15 years, then operate at full production (no "shut ins"). It was also assumed that a mix of VOC emission control measures would be required, which reduces VOC emissions, but increases NO_x emissions. Finally, an EPA-approved dispersion model was applied in a "screening" approach; air pollutant emissions were assumed to transport directly and instantaneously to receptor locations, without additional dispersion by terrain (a "flat earth" assumption). Based on these conservative "worst case" analysis assumptions, no significant air quality impacts are anticipated from the Proposed Action or alternatives.

Potential air quality impacts were analyzed based on an assessment protocol which was developed by TRC Environmental Corporation for the BLM. This protocol was developed and applied in consultation with, and review by, the Operators, EPA (Region VIII), the USFS (Regions 2 and 4), the Wind River Environmental Quality Commission (Shoshone and Arapaho Tribes), WDEQ-AQD, and the Wyoming Outdoor Council.

Air pollution impacts are limited by state and federal regulations, standards, and implementation plans established under the Clean Air Act and administered by WDEQ-AQD. Therefore, before any air pollutant emitting activity can occur, WDEQ-AQD requires pre-construction air quality emission permits which limit expected emissions from specific project components (such as natural gas well production facilities and compressors). Additional site-specific air quality analysis would be performed, and additional emission control measures including "Best Available Control Technology" (BACT) may be required, to ensure protection of air quality resources.

In addition, under FLPMA and the Clean Air Act the BLM cannot conduct or authorize any activity which does not conform to all applicable local, state, tribal, and federal air quality laws, statues, regulations, standards, and implementation plans. An extensive air quality impact assessment report (Technical Support Document) is being prepared for this project and is summarized below.

4.1.1.1 Proposed Action

No violations of applicable federal or state air quality regulations or standards are expected to occur as a result of direct, indirect, or cumulative project emissions (including construction and operation). Potential emission levels would meet PSD Class I and Class II increment limits, although there is a potential for direct and cumulative visibility impacts to exceed the USFS's "Limit of Acceptable Change" within the PSD Class I Bridger Wilderness Area. Additionally, some impact, albeit less than that described for the PSD Class I areas, could occur within Wind River Indian Reservation Roadless Areas (WRIRRAs).

The maximum potential "near field" air pollutant concentrations would occur close to and between well locations; the maximum ground level concentrations would be so close to each well location that adding additional wells throughout the field would not increase the overall maximum concentration.

Potential "far field" air quality impacts would be below applicable atmospheric deposition Limits of Acceptable Change criteria at the Bridger Class I Wilderness Area for total sulfur and nitrogen deposition and sensitive lake changes in pH and Acid Neutralizing Capacity (ANC). Given the inherent conservatism in the analysis, it is unlikely project operation emissions would result in perceptible visibility impacts on even the clearest days in the PSD Class I Bridger Wilderness Area, although the screening level analysis predicted that operations could result in a single perceptible (1.0 deciview) visibility impact on 1 day (based on January 19, 1995, meteorology). At the request of the USFS, potential visibility impacts were also calculated for the Bridger Wilderness Area "Limit of Acceptable Change" of 0.5 deciview. In addition to the single 1.0 deciview value, the screening model also predicted 5 days at 0.6 deciview (all under the assumed January 1995, meteorology conditions), and five days at 0.5 deciview (under the assumed January, February, November, and December 1995, meteorology conditions). While not modeled, impacts on the WRIRRAs would be the same or less than those identified for the Bridger Wilderness Area.

In reviewing these predicted impacts, it is important to understand the assumptions made regarding resource development. In developing this analysis, there is a great deal of uncertainty in specific project plans (i.e., number of wells, equipment to be used, specific locations) for resource development. All of these factors affect air emissions, as well as predicted air quality impacts. This analysis was based on a conservative "worst case" scenario, including the amount of development (number of wells), equipment necessary to produce the resource to its maximum capacity, well spacing, and assumed emission sources. Thus, the projected impacts are a conservative upper estimate of potential air quality effects that are unlikely to be reached.

It is also important to note that before development could occur, the WDEQ-AQD requires specific air pollutant emission preconstruction permits which examine potential project-specific air quality impacts. As part of these permits (depending on source size), WDEQ-AQD could require a cumulative air quality impacts analysis. Thus, as development occurs, additional site-specific air quality analysis would be performed to ensure protection of air quality resources.

"Near field" air quality impact modeling was used to predict maximum potential concentrations in the vicinity of the emission sources for comparison with applicable air quality standards and PSD Class II increments. This modeling was performed to quantify potential "worst case" impacts from particulates and

SO_2 emissions during construction and CO and NO_x emissions during production.

Using maximum well location densities (eight wells per 640-acre section, or 80-acre spacing) and maximum proposed compression, a representative well field "patch" was assumed to determine a realistic "worst case" geometric layout of eight wells and one 5,000 horsepower compressor engine. The ISCST3 dispersion model was used with meteorological data measured during 1995 near Rock Springs, Wyoming. For all modeling, the proposed compressors and well location separator and dehydrator heaters were modeled as specific point sources.

Maximum potential TSP and PM_{10} emissions from traffic on unpaved roads and during well pad construction were used to determine the maximum 24-hour TSP and PM_{10} concentrations and the annual average PM_{10} concentration. Maximum emissions would be temporary (i.e., occurring during a 60-day construction period) and would occur in isolation, without significantly affecting neighboring well locations. It was assumed that water and/or chemical dust suppressants would be applied to minimize TSP and PM_{10} fugitive dust emissions from well pad and resource road construction. The control efficiency of watering and/or dust suppressants was computed at 50%, at an (assumed) application rate of 0.02 gal per square yard for watering.

The maximum potential concentrations 200 m from the source (including representative background values) would be nearly 90 $\mu g/m^3$ (PM_{10} 24-hour), 21 $\mu g/m^3$ (PM_{10} annual), and 140 $\mu g/m^3$ (TSP 24-hour). Therefore, all predicted short- and long-term particulate matter concentrations would comply with the WAAQS of 150 $\mu g/m^3$, 50 $\mu g/m^3$, and 150 $\mu g/m^3$, respectively (see Table 3.2). Since these construction emissions are temporary, PSD increments are not applicable.

The predicted maximum 24-hour concentrations overestimate actual expected concentrations because it is assumed the maximum modeled concentrations due to natural gas operations coincide with the maximum measured background concentrations. However, the meteorological conditions which lead to two maximum situations would be very different and are not likely to coincide in the same location at the same time.

The maximum short-term (3- and 24-hour) and long-term (annual average) SO_2 emissions would occur from drilling rigs and other diesel engines used during rig-up, drilling, and completion operations. These SO_2 emissions would be temporary, occurring during a limited construction period at each well location. The maximum modeled concentrations (including representative background values) would be nearly 152 $\mu g/m^3$ (3-hour), 48 $\mu g/m^3$ (24-hour), and 10 $\mu g/m^3$ (annual). Therefore, all predicted short- and long-term SO_2 concentrations comply with the applicable WAAQS of 1,300 $\mu g/m^3$, 260 $\mu g/m^3$, and 60 $\mu g/m^3$, respectively (see Table 3.2); the NAAQS are slightly less restrictive. Since these sources are temporary in nature, PSD increments would not apply.

The maximum direct CO impacts, which would occur due to compressor engine emissions throughout production, were predicted to be nearly 226 $\mu g/m^3$ (1-hour) and 185 $\mu g/m^3$ (8-hour). These concentrations do not exceed PSD "significant" levels (specifically 2,000 $\mu g/m^3$ 1-hour and 500 $\mu g/m^3$ 8-hour as reported in EPA [1990]), therefore, by definition, there would be no significant CO air quality impacts. When these values are added to the assumed background concentrations, they become nearly 3,726 $\mu g/m^3$ (1-hour) and 1,685 $\mu g/m^3$ (8-hour), demonstrating compliance with the WAAQS and NAAQS for CO of 40,000 $\mu g/m^3$ (1-hour) and 10,000 $\mu g/m^3$ (8-hour) (see Table 3.2).

Maximum NO_x emissions are expected to occur from compressors during production. The maximum potential "near field" NO_2 concentrations were determined by multiplying maximum NO_x concentrations by 0.75, in accordance with standard EPA methodology (Federal Register 60:153, p. 40469, dated August 9, 1995). The maximum predicted direct NO_2 impact was 12 $\mu g/m^3$, which is well below the applicable PSD Class II increment of 25 $\mu g/m^3$ (see Table 3.3). When this value is added to the assumed representative background concentration (10 $\mu g/m^3$), the resulting predicted maximum total impact is 22 $\mu g/m^3$, which is also below the WAAQS and NAAQS of 100 $\mu g/m^3$ (see Table 3.2).

Ozone is formed in the atmosphere by a photochemical reaction involving ambient concentrations of VOC and several oxides of nitrogen (NO_x). Because of this complex photochemical process, a specific ozone nomograph developed from the Reactive Plume Model was used to predict

potential impacts. This prediction method first computes a potential VOC to NO_x emission ratio, then uses the nomograph to compare this ratio to potential VOC emissions, ultimately predicting a potential ozone concentration.

At the predicted ratio (1.7:1), the nomograph estimated maximum potential "near field" ozone concentrations of 0.015 parts per million (nearly 30 $\mu g/m^3$). When added to a background ozone concentration of 110 $\mu g/m^3$, the total predicted ozone impact would be 140 $\mu g/m^3$, which is below the restrictive WAAQS of 160 $\mu g/m^3$; the NAAQS is less restrictive. This predicted impact is conservative since the nomograph was developed using meteorological conditions more conducive for forming ozone than would be found in southwestern Wyoming.

The potential emission rates of several hazardous air pollutants (HAPs) were evaluated for the production phase, including formaldehyde (approximately 9.8 tons per year [tpy]), n-hexane (6.6 tpy), benzene (1.3 tpy), toluene (2.8 tpy), ethyl benzene (0.2 tpy), and xylene (1.6 tpy) from individual well site dehydrators, separators, storage tanks, and a 5,000 hp compressor station. Potential HAP impacts were predicted using the ISCST3 model and an 8-hour averaging time, then compared to a range of state Threshold Limit Values (TLVs) (EPA 1997a). As summarized in Table 4.2, formaldehyde is the only pollutant predicted to exceed the lower end of the range of state TLVs (the minimum state TLV for formaldehyde of 4.5 $\mu g/m^3$ was established by the Pinellas County, Florida, Air Pollution Control Board). The State of Wyoming has not identified specific TLVs for HAPs.

Long-term (70-year) exposures from suspected carcinogenic emissions (e.g., benzene and formaldehyde) were used to estimate the latent cancer risk at the nearest residence (4 mi from a well site and compressor). These were calculated from EPA (1997b) unit risk factors for carcinogenic constituents Threshold Limit Values. Two estimates of cancer risk were made; one that corresponds to a most likely exposure (MLE) condition, and one reflective of the maximally exposed individual (MEI). The estimated cancer risks were adjusted to account for duration of exposure and time spent at home.

Under the MLE analysis, a "patch" of eight wells was assumed to emit benzene from 1.3 tpy (maximum uncontrolled) to 0.2 tpy (reflecting a more likely, controlled emission rate), and the estimated cancer risks associated with long-term exposure are 1 x 10^{-6} to 2 x 10^{-7}. The MLE analysis for formaldehyde (which is already subject to NO_x BACT), calculated risk is 4 x 10^{-8}. Therefore, the estimated total MLE cancer risk for the inhalation pathway ranges from 1 x 10^{-6} to 2 x 10^{-7}. All of these estimated risks are at or below the 1 x 10^{-6} to 1 x 10^{-4} threshold range.

Under the MEI analysis, the individual cancer risks for benzene ranges from 3 x 10^{-6} (uncontrolled) to 5 x 10^{-7} (controlled). The formaldehyde MEI risk is calculated to be 1 x 10^{-7}, and the total cancer risk for the inhalation pathway ranges from 3 x 10^{-6} to 6 x 10^{-7}. This total risk falls on the lower end of the 1 x 10^{-6} to 1 x 10^{-4} range which is considered acceptable. In addition, given the conservative nature of the MEI analysis, the exposures in this scenario more than likely overstate what any individual would actually experience. Finally, at the distances involved, it is unlikely that a residence would be affected by more than one well or compressor engine at any given time (i.e., there would be no cumulative incremental risk).

4.1.1.2 Alternative A - Sensitive Resource Protection

Due to limited surface disturbance, total construction-related air quality impacts from Alternative A would be somewhat less than those described for the Proposed Action, although "near field" maximum impacts would remain the same.

4.1.1.3 Alternative B - Maximum Location Density

Given the fewer number of wells and less dense spacing, air quality impacts from Alternative B would be less than those described for the Proposed Action, especially "far field" impacts at the PSD Class I Bridger Wilderness Area and the WRIRRAs.

4.1.1.4 No Action Alternative

Implementation of the No Action Alternative would eliminate the incremental air quality impacts associated with the Proposed Action and alternatives. However, continuing impacts from existing sources, as well as additional impacts to air quality from sources already permitted but not yet operational, would occur.

Table 4.2 Potential HAP Concentrations and Comparable State Threshold Limit Values, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.[1]

Pollutant	Concentration ($\mu g/m^3$)[2]	Range of State TLVs ($\mu g/m^3$)[2]
Formaldehyde	12.5	4.5 - 71
n-Hexane	623	1,800 - 4,290
Benzene	83	30 - 714
Ethyl benzene	13	4,340 - 43,500
Toluene	178	1,870 - 8,930
Xylene	102	2,170 - 4,400

1 These maximum predicted concentrations would occur within 100 m of well locations. As the distance from locations increases, the predicted concentrations decrease rapidly.

2 TLV = threshold limit value; $\mu g/m^3$ = micrograms per cubic meter.

4.1.1.5 Mitigation and Monitoring

Mitigation. Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced to reduce the amount of fugitive dust generated by traffic or other activities, and dust inhibitors (i.e., surfacing materials, non-saline dust suppressants, water) could be used as necessary on unpaved collector, local, and resource roads which present a fugitive dust problem. To further reduce fugitive dust, Operators could establish and enforce speed limits (15-30 mph) on all project-required roads in and adjacent to the J2PA.

The air quality impact assessment also evaluated potential NO_x mitigation measures to further reduce NO_x emissions for natural gas-fired, internal combustion compressor engines. The evaluation was not intended to rank or identify a required technology for the proposed compressors; the appropriate level of control would be determined and required by the WDEQ-AQD during the preconstruction permit process. In developing the emission inventory for the J2PA assessment, it was assumed that compressor engines would have an average emission rate of approximately 2 g NO_X per horsepower-hour (hp-hr) of operation. This reflects the use of current BACT. Alternate control measures include:

- Reducing the need for LOP compression by installing larger pipelines.
- Nonselective Catalytic Reduction. This control technology is applicable to relatively new engines and requires the installation of catalysts in the engine exhaust. The catalyst removes between 80 and 90% of the uncontrolled NO_X emissions, for an operating emission rate of 1-5 g/hp-hr. Costs are approximately $110-180/ton removed.
- Lean Combustion. This technology involves the increase of the air-to-fuel ratio to lower the peak combustion temperature, thus reducing the formation of NO_X (new engines and retrofit applications). The controls are between 80 and 90% efficient, for an operating emission rate of 1.5-4 g/hp-hr. Costs are $490-690/ton removed.
- Selective Catalytic Reduction. This is a post-combustion control technology which is only applicable to exhaust streams with significant oxygen content (a lean burn engine). The controls are between 80 and 90% efficient, for an operating emission rate of 1-2.5 g/hp-hr. Costs are $750-9,600/ton removed.

To reduce VOC emissions, untreated gas from four or more wells could be transported by pipeline to a single centralized collection/treatment battery (separator and dehydrator units). Additional VOC control from condensate storage facilities, such as including flaring of VOC emissions or VOC capture devices, could also be required. Again, this evaluation was not intended to rank or identify a required technology for the proposed compressors; the appropriate level of control would be determined and required by the WDEQ-AQD during the preconstruction permit process.

Monitoring. The BLM could continue to cooperate with existing visibility and atmospheric deposition impact monitoring programs. The need for and the design of additional monitoring could include the involvement of the Interagency Committees on Air Quality. Based upon the Committees' recommendations, operators could be required to cooperate in the implementation of a coordinated air quality monitoring program. Section 6 of the oil and gas lease terms require the lessee, within the lease rights granted, to take measures deemed necessary by the lessor for the conduct of operations in a manner that minimizes adverse impacts to air, as well as other resources.

The BLM, in cooperation with WDEQ-AQD, will track total NO_x emissions within the Rock Springs District. Tracking total NO_x emissions will require close coordination between federal land management and state environmental regulatory agencies regarding receipt of applications for NO_x emitting sources and maintenance of a NO_x emissions inventory. The BLM and WDEQ-AQD have agreed to cooperate in the monitoring and tracking of NO_x emission levels within the Rock Springs District (including the Moxa Arch, Fontenelle, Stagecoach Draw, and Jonah I development areas) and share data with each other and other interested parties when requested. The procedure to be followed by the BLM and WDEQ-AQD in tracking NO_x emissions is defined in a written agreement between the BLM Rock Springs District Manager and the WDEQ-AQD Director. Tracking will include documentation of decreases in NO_x emissions from existing sources (e.g., plugged/abandoned wells; retrofitting compressors, wells, power plants, etc., with BACT) and increases in NO_x emissions due to the permitting of activities which result in new sources. Tracking will include documentation of the type of emitting facility, owner of the facility, location of the source, NO_x emitted in tons/year, and other pertinent information deemed necessary by the BLM, WDEQ-AQD, USFS, and EPA Region VIII to ascertain change in NO_x emissions.

4.1.1.6 Cumulative Impacts

A cumulative air quality impact assessment was performed to predict potential air quality impacts at the PSD Class I Bridger Wilderness Area to:

- calculate (through a screening analysis) whether the PSD Class I NO_2 increment would be exceeded;
- calculate potential nitrate and sulfate deposition (and their related impacts) in sensitive lakes; and
- predict potential impacts to regional visibility.

Potential emissions from the Proposed Action and alternative well field developments were modeled with numerous other sources to determine the overall potential cumulative air quality impact.

Several existing sources were assumed to already be impacting the area, as indicated by existing monitoring (background) conditions, including South Baxter, UPRC Brady, Patrick Draw, Dripping Rock, Hay Reservoir, Nichie Gulch, Big Piney/LaBarge, Hiawatha, N. Evanston, S. Evanston, and Whitney Canyon.

Additional sources were included where NEPA documents have been prepared but field development has only partially, or not, occurred including: Moxa Arch, Fontenelle, Jonah EA, Stagecoach Draw, Greater Wamsutter Area II, Mulligan Draw, Creston/Blue Gap, and BTA/Bravo.

Also considered in the modeling assessment were other sources in southwestern Wyoming that have undergone permitting (i.e., New Source Review) by WDEQ-AQD, but are not yet in operation, including Amoco Big Sand Draw, Exxon Bridger Fork Production Facilities, FMC Wyoming Corporation, General Chemical, OCI Wyoming L.P., Questar Eakin Station, Sweetwater Methanol, SF Phosphates, Solvay Trona, Texaco-Table Rock, Texasgulf-Soda Ash, UPRC- Brady, and -Patrick Draw, Wold Trona, WGR-Eagles Nest and -Granger, and Williams Field Service-Echo Springs, -Frewen Lake, -Moxa North, -Moxa South, and -Opal natural gas liquids plants.

It is important to consider that the following conservative assumptions have been incorporated into this analysis when reviewing the modeling results.

- The projected impacts reflect "screening" level modeling (a modeling approach that is conservative by design).

- All emission units were assumed to be operating at potential emission rates simultaneously. Given the number of sources included in this analysis (approximately 14,000), the probability of such an emissions scenario occurring over an entire year or over a 24-hour time period is extremely small. While this assumption is typically used in such modeling analyses, the resulting impacts are likely to be overstated, and as the number of sources increases, the level of conservatism also increases.

- The ISCST3 model utilizes instantaneous straight line plume transport. Thus, the model does not account for the actual travel time, distance, nor the nonlinear path a plume would undergo as it is transported from a source to the PSD Class I Bridger Wilderness Area. Because of this assumption, the model overestimates the number of times that a plume actually reaches a sensitive receptor; based on a less conservative "puff" model analysis, it is more likely a plume would impact the Class I area only 67% of the time. Also, because the model cannot predict the varying route of an actual plume, the travel distance is underestimated and the concentration is again overstated. This limitation is less important for near field assessments, but for plume distances greater than 30 mi, these assumptions are very conservative.

- The ISCST3 model also conservatively addresses plume transport for significant elevation increases, up to and greater than 4,000 ft, in complex terrain. Even though a trajectory could transport the plume toward the PSD Class I Bridger Wilderness Area, it would not climb the elevation increase necessary in a direct straight line to reach the sensitive receptors.

The maximum predicted cumulative NO_2 concentration at the Bridger Class I Wilderness Area boundary would be 0.06 $\mu g/m^3$, reflecting the conservative "worst-case" emissions assumptions. Therefore, the NO_2 PSD Class I increment of 2.5 $\mu g/m^3$ would not be exceeded. Sulfur emissions from construction activities would not consume the SO_2 PSD Class I increments. It should be noted that this comparison is not a complete PSD increment consumption analysis, but an assessment indicating that the increment would not be exceeded by the Proposed Action or alternatives. At the time of a preconstruction air quality permit application, WDEQ-AQD may require a much more detailed PSD increment consumption analysis.

The maximum predicted cumulative SO_2 and NO_2 concentrations were also computed for specific sensitive lake locations within the Wind River Mountain wilderness areas (e.g., Saddlebag and Deep Lakes). The lakes were identified by the USFS as those which are sensitive to atmospheric deposition and for which the most recent and most complete data have been collected.

The USFS also expressed concern regarding Klondike Lake because its ANC, approximately 20 microequivalents per liter, is very low (BLM 1996b). The Klondike Lake ANC measurement is a single 1984 value, and no subsequent measurements of ANC have been made. However, if the ANC at Klondike Lake is currently 20 microequivalents per liter, any additional nitrogen deposition would exceed the USFS ANC "Limit of Acceptable Change."

Saddlebag Lake was the most sensitive receptor, based on existing lake chemistry, location, and potential SO_2 and NO_2 impacts. Atmospheric deposition at Saddlebag Lake was predicted to be 0.06 kilograms per hectare-year (kg/ha-yr) nitrogen and 0.02 kg/ha-yr sulfur, compared to threshold values of 3 kg/ha-yr and 5 kg/ha-yr, respectively (BLM 1996b). Potential pH change in Saddlebag Lake was predicted to be 0.003 delta pH, well within the threshold of 0.1 pH units. Potential change in ANC at Saddlebag Lake was estimated at 0.6%; the allowable threshold change is 10% for lakes with existing ANC greater than 25 microequivalents per liter.

Deep Lake is less sensitive, but has been monitored more intensively by the USFS. Potential direct annual atmospheric deposition-related impacts were predicted

to be 0.05 kg/ha-yr nitrogen and 0.01 kg/ha-yr sulfur, with a potential pH change of 0.002 delta pH. The estimated potential change in ANC is 0.4%. The USFS has indicated a concern that the water in Deep Lake takes 2.7 years to fully exchange; therefore, ANC impacts could occur over multiple years. Assuming there are no other ecosystem components that affect multiple year ANC values (a very conservative, "worst case" assumption), if the maximum annual nitrogen and sulfur deposition rates were multiplied by 2.7, the long-term predicted change in ANC would be estimated at 1.2%. All predicted impacts are below the significance criteria listed above.

Since the proposed emissions constitute many small sources uniformly spread out over a very large area, discrete visible plumes are not likely to impact the PSD Class I Bridger Wilderness Area or WRIRRAs, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze or visibility degradation is caused by fine particles and gases scattering and absorbing light. Changes to regional haze are measured in terms of perceptible visibility differences below ambient background conditions.

The Interagency Workgroup on Air Quality Modeling (IWAQM) has prepared a methodology for estimating changes to regional haze (IWAQM 1993). This method involves modeling SO_2, NO_2, and particulate emissions to estimate airborne fine particle concentrations at the PSD Class I area, then computing an increase in extinction coefficient (interpreted as a "deciview change") in addition to measured background conditions. The magnitude of the deciview change is used as an indicator for increases to regional haze.

A deciview change of 1.0 is considered potentially significant, as adopted by the Grand Canyon Visibility Transport Commission and reported in Pitchford and Malm (1994) and is defined as about a 10% change in extinction coefficient, which is a small but perceptible scenic change under many circumstances (BLM 1996b). The 1.0 deciview value corresponds to a 2-5% change in contrast, for a "black target" against a clear sky, at the most optically sensitive distance from an observer.

Factors such as the magnitude of deciview change, frequency, time of the year, and the meteorological conditions during times when deciview thresholds are above 1.0 (as well as inherent conservatism in the modeling analyses) should all be considered when determining the significance of potential impacts.

The ISCST3 model was used to estimate the maximum 24-hour average pollutant impacts at Fremont Lake, where background visibility measurements have been collected representative of the PSD Class I Bridger Wilderness Area. For this conservative "worst case" scenario, NO_2 is the only pollutant of concern, since no sulfur emissions would occur during production. The background standard visual range data were measured hourly, concurrent with the 1995 meteorology data, and provided by the IMPROVE monitoring program.

Assuming conservative "worst-case" emissions and modeling assumptions, cumulative operations are predicted to result in perceptible (1.0 deciview reduction) visibility impacts on 9 days annually. The cumulative frequency distribution of these data indicate 98% of the estimates have a predicted deciview of less than 1.0. These data were further examined for the time of occurrence; the 1.0 deciview threshold was predicted to be exceeded on 9 days during the winter and no days during the non-winter period. Given the inherent conservatism in the analysis, it is unlikely (but not impossible) that cumulative "worst-case" emissions from throughout southwestern Wyoming could cause significant regional haze impacts in the PSD Class I Bridger Wilderness Area.

This regional haze analysis was conducted using conservative assumptions regarding emissions, plume transport time, humidity, and the conversion of NO_X to ammonium nitrate. It was assumed that 75% of the NO_X would convert to NO_2, and that all the NO_2 would convert to nitrate particles. In all likelihood, the amount of NO_X that converts to ammonium nitrate particles would be significantly less.

The USFS has established a 0.5-deciview "Limit of Acceptable Change" to evaluate potential significant visibility impacts at the PSD Class I Bridger Wilderness Area. Based on this more restrictive 0.5-deciview level, cumulative operations are predicted to exceed the USFS "Limit of Acceptable Change" for visibility impacts on 37 days annually. These data were further examined for the time of occurrence; the 0.5 deciview threshold was predicted to be exceeded

on 28 days during the winter, and 9 days during the non-winter period.

4.1.1.7 Unavoidable Adverse Impacts

Some increase in air pollutant emissions would occur as a result of the Proposed Action and alternatives; however, based on the conservative "worst-case" modeling assumptions, these impacts are predicted to be below applicable significance thresholds. However, there is a potential for direct and cumulative visibility impacts to exceed the USFS's "Limit of Acceptable Change" within the PSD Class I Bridger Wilderness Area.

4.1.2 Geologic Hazards

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with geologic hazards:

- to protect the health and safety of the public and the well-being of sensitive natural resources;
- to minimize the loss of life and property from natural hazards; and
- to generate and provide data on development limitations.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.1.2.1 The Proposed Action

The depth of gas reserves in the J2PA and the lack of underground mines in the area negate the potential for subsidence. There are no known active faults within the J2PA, the overall potential for seismicity is low, and all facilities would be designed and constructed to withstand the effects of moderate earthquakes (see Section 2.4.11.4 [1]); therefore, no impacts from earthquakes are anticipated. Since there are no known landslides within the J2PA, the Proposed Action is not anticipated to affect or be affected by landslides.

4.1.2.2 Alternative A - Sensitive Resource Protection

The results of implementing Alternative A would be similar to those for the Proposed Action.

4.1.2.3 Alternative B - Maximum Location Density

The results of implementing Alternative B would be similar to those for the Proposed Action.

4.1.2.4 No Action Alternative

Under the No Action Alternative there would be no additional impacts to or from subsidence, landslides, and earthquakes.

4.1.2.5 Mitigation

No additional mitigation is identified.

4.1.2.6 Cumulative Impacts

The CIAA for geologic hazards is the combined Jonah EA and J2PA project areas (approximately 64,400 acres [100.6 mi^2]) (see Map 4.1 and Table 4.1). Approximately 543 acres (0.8%) of the CIAA has been disturbed, primarily by roads and pipeline ROWs (66.3% of the existing disturbance) (Table 4.3). RFD disturbance, as defined in Section 4.0, would contribute an additional 2 acres of long-term disturbance from new natural gas exploration activities to existing surface disturbance in the geologic hazards CIAA. Therefore, the maximum cumulative disturbance, which includes 934 acres of disturbance from the proposed project, would be 1,479 acres (2.3% of the CIAA). While additional surface disturbance would occur as a result of the proposed project in combination with existing disturbance and RFD, the proposed project is not anticipated to adversely affect or be affected by subsidence, landslides, and earthquakes; therefore, no cumulative impacts to or from geologic hazards are anticipated.

4.1.2.7 Unavoidable Adverse Impacts

There would be no unavoidable impacts due to geological hazards.

4.1.3 Paleontology

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with paleontologic resources:

- to expand the opportunities for scientific study and educational and interpretive uses of paleontologic resources;

Table 4.3 Acreage of Long-term Surface Disturbance in the Cumulative Impact Assessment Area for Geologic Hazards, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.[1]

Item	Total Existing Disturbance	Proposed Development				Maximum Total Cumulative Disturbance[5]
		Proposed Action	Alternative A[2]	Alternative B[3]	RFD[4]	
Roads/pipeline ROWs	360	598	561	460	--	958
Oil/gas wells	24	315	296	243	2	341
Reservoirs	105	--	--	--	--	105
Other disturbance	54	21	21	21	--	75
Total	543	934	878	724	2	1,479

[1] Cumulative impact assessment area for geologic hazards totals approximately 64,400 acres (100.6 mi^2).
[2] Proposed LOP disturbance is assumed to be reduced from Proposed Action by approximately 6%.
[3] Proposed LOP disturbance is assumed to be reduced from Proposed Action by 21-23%.
[4] RFD = Reasonably foreseeable development as defined in Section 4.0 (i.e., an assumption of 0.023 acre of disturbance per mi^2).
[5] Based on implementation of the Proposed Action.

- to protect and preserve important paleontologic resources of their historic record for future generations; and
- to resolve conflicts between paleontologic resources and other resource uses.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.1.3.1 The Proposed Action

Applicant-committed practices would require a survey by a qualified paleontologist prior to any surface disturbance in areas with a high likelihood of encountering fossils (see Section 2.4.11.4 [2]). All operations that would further disturb any fossils uncovered during surface-disturbing activities would be suspended until a determination of significance was made and, if appropriate, a recovery or avoidance plan was developed (see Section 2.4.11.4 [3]). Excavation could uncover fossils of significant scientific importance that otherwise would have remained buried and unavailable for scientific study. Indirect impacts to fossil resources could occur from illegal collection or vandalism of newly exposed areas, and improved access to the J2PA that could facilitate an increase in illegal collecting.

4.1.3.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would impact paleontologic resources in the same way as the Proposed Action; however, a 6% reduction in surface disturbance would reduce the chance of encountering fossils as compared to the Proposed Action.

4.1.3.3 Alternative B - Maximum Location Density

Implementation of Alternative B would impact paleontologic resources in the same way as the Proposed Action; however, a 21-23% reduction in surface disturbance would reduce the chance of encountering fossils as compared to the Proposed Action.

4.1.3.4 No Action Alternative

Under the No Action Alternative, there would be no additional surface disturbance other than that previously approved in the Jonah EA. The DR and FONSI for the Jonah EA determined that project would not have significant impacts on paleontologic resources. The potential to uncover additional significant fossils would be foregone under the No Action Alternative.

4.1.3.5 Mitigation

Construction workers could be instructed about the potential of encountering fossils in the J2PA and the steps to take if fossils are discovered during project-related activities. The illegality of removing fossil materials from federal lands without an appropriate permit could be explained.

4.1.3.6 Cumulative Impacts

The CIAA for paleontologic resources is a 465.5-mi^2 (297,920-acre) area surrounding the J2PA (see Map 4.1). Existing disturbance in this CIAA comprises 3,132 acres (1.1% of the CIAA), most (66.9%) of which is roads and pipeline ROWs (Table 4.4). Currently, the activities approved in the Jonah EA comprise the majority of existing oil and gas activities in the area. Other activities include livestock grazing and recreation, which have few impacts on paleontologic resources, other than the possibility of increasing opportunities for illegal collecting. RFD disturbance, as defined in Section 4.0, would contribute an additional 11 acres of long-term disturbance from new natural gas exploration activities to existing surface disturbance in the paleontologic CIAA. Therefore, the maximum cumulative disturbance, which includes 934 acres of disturbance from the proposed project, would be 4,077 acres (1.4% of the CIAA).

The implementation of applicant-committed practices described in Section 2.4.11.4 would minimize impacts to paleontologic resources in the J2PA, and the DR and FONSI for the Jonah EA determined that project would not have significant impacts on paleontologic resources. Improvements of the Luman and Burma Roads and the construction of new roads would increase access to the CIAA, resulting in increased opportunities for illegal collecting.

4.1.3.7 Unavoidable Adverse Impacts

A limited amount of illegal collecting could result from improved access to the J2PA, and fossils could be damaged by accidental contact during construction.

4.1.4 Mineral Resources

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with mineral resources:

- to provide for leasing, exploration, and development of oil and gas, while protecting other resource values;
- to coordinate land use decisions with economic factors and needs;
- to plan land use consistent with the orderly development, use, and conservation of renewable and nonrenewable natural resources; and
- to plan uses that encourage the conservation of energy.

The following analyses show that the Proposed Action is compatible with these management objectives, and no significant impacts are anticipated; however, Alternatives A and B may result in a significant adverse impact if natural gas resources are not fully recovered. In addition, the No Action Alternative would deny exploration and development of oil and gas reserves on existing leases; therefore, this alternative would not be in accord with BLM, state, and local land use plans, and a significant negative impact would occur for mineral resources.

4.1.4.1 The Proposed Action

Implementation of the Proposed Action would result in the depletion of recoverable gas and oil reserves from the Lance Formation and possibly other formations underlying the project area. Average production for each well is expected to be 0.5 to >5.0 mmcfpd of natural gas and approximately 5 to 45 bbl of condensate per day. Total production of natural gas and condensates from the field during the first 10 years of operations are estimated at 617,610 mmcf and 4,940 million bbl, respectively. The federal government has leased the federal mineral estate to achieve maximum recovery of the mineral resource to meet present and future demands for natural gas, to obtain a 12.5% federal royalty to the

Table 4.4 Acreage of Long-term Surface Disturbance in the Cumulative Impact Assessment Area for Paleontological and Cultural Resources, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.[1]

Item	Total Existing Disturbance	Proposed Development				Maximum Total Cumulative Disturbance[5]
		Proposed Action	Alternative A[2]	Alternative B[3]	RFD[4]	
Roads/pipeline ROWs	2,094	598	561	460	--	2,692
Oil/gas wells	75	315	296	243	11	401
Reservoirs	359	--	--	--	--	359
Dwellings	46	--	--	--	--	46
Agricultural lands	305	--	--	--	--	305
Other disturbance	253	21	21	21	--	274
Total	3,132	934	878	724	11	4,077

1 Cumulative impact assessment area for paleontological and cultural resources totals approximately 297,920 acres (465.5 mi^2).
2 Proposed LOP disturbance is assumed to be reduced from Proposed Action by approximately 6%.
3 Proposed LOP disturbance is assumed to be reduced from Proposed Action by 21-23%.
4 RFD = Reasonably foreseeable development as defined in Section 4.0 (i.e., an assumption of 0.023 acre of disturbance per mi^2).
5 Based on implementation of the Proposed Action.

federal government, and in response to the Clean Air Act amendments of 1990 to minimize air pollution.

The Proposed Action would not interfere with the recovery of coal, oil shale, trona, and other minerals because these minerals are not available in minable quantities in the J2PA. Sand and gravel resources in the J2PA would still be available for recovery.

4.1.4.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce results similar to those for the Proposed Action with one exception: limiting well locations within 0.5 mi of sage grouse leks and active raptor nests could result in the failure to recover natural gas reserves from portions of existing leases. If directional drilling is used to fully recover these natural gas reserves, the risk and costs associated with drilling and producing wells would be increased for the Operators.

4.1.4.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce results similar to those for the Proposed Action except that complete recovery of natural gas resources could be impossible as a result of limiting spacing to 160 acres (4 well locations/section), or uneconomical because of the additional time or expense required for complete recovery. If directional drilling is used to fully recover these natural gas reserves, the risk and costs associated with drilling and producing wells would be increased for the Operators.

4.1.4.4 No Action Alternative

Under the No Action Alternative, the natural gas reserves in the J2PA proposed for recovery under the action alternatives would not be recovered at this time, but would be available at some later date. However, natural gas reserves in the portion of the J2PA that has been approved in the Jonah EA would be recovered. No impacts associated with the Proposed Action would occur. The No Action Alternative would violate the contractual agreement between the United States and the lessees and would be outside of the jurisdiction of the BLM to implement without Congressional authorization. Additional adverse impacts associated with the loss of government revenues, regional employment opportunities, and associated salaries are described in Section 4.4.4.

4.1.4.5 Mitigation

Complete mitigation for the lack of drainage of natural gas in Alternative A could be accomplished by directional drilling into the producing formations beneath the surface area set aside to protect sage grouse leks and active raptor nests. Directional drilling would be a viable mitigation measure only if it would be economically feasible.

Partial, to complete, mitigation for the lack of drainage of natural gas in Alternative B could be accomplished by some combination of directional drilling and other measures to limit disturbance to sensitive resources. Other measures could include remote monitoring of wells and pipelines to transport condensates and/or produced water to central gathering points. Both of these measures would reduce human activities in the vicinity of the well location during production.

4.1.4.6 Cumulative Impacts

The CIAA for mineral resources is the combined J2PA and Jonah EA project areas (see Map 4.1). Natural gas reserves would be recovered from this area, as would associated oil reserves, in compliance with BLM policy. Cumulative impacts to mineral resources in the CIAA would be the same as described for the alternatives.

4.1.4.7 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to mineral resources due to any of the action alternatives unless the natural gas resources were not maximally recovered, in which case the unrecovered gas would constitute an adverse impact. However, the natural gas and oil resources recovered by this project would not be available for future generations.

4.1.5 Soils

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with soils:

- to stabilize and conserve soils;
- to increase vegetative production;
- to maintain or improve surface and groundwater quality; and
- to protect, maintain, or improve wetlands, floodplains, and riparian areas.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.1.5.1 The Proposed Action

Direct impacts to soils would include removal of vegetation, exposure of the soil, mixing of soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to wind and water erosion. These impacts could, in turn, result in increased runoff, erosion, and sedimentation. Increased surface runoff and erosion would occur primarily in the short-term and would decline in time due to natural stabilization through particle aggregation, soil structure development, and armoring. Short-term control of surface runoff would be dependent on the success and implementation of reclamation and revegetation efforts described in Appendix B, Surface Use Plans or Plans of Development prepared for each APD and/or ROW application, and SWPPPs. Following application of reclamation and revegetation procedures, the susceptibility of disturbed areas to soil erosion would be minimized for both the short-term and the LOP.

The potential for contamination of soils due to the accidental discharge would be limited by appropriate project implementation procedures and the remedial measures applied as specified in SPCCPs (see Section 4.7).

The Proposed Action would result in new disturbance of 3,250 acres of soils (5.4% of the J2PA). Approximately 68% (2,164 acres) of this disturbance would be short-term (i.e., reclaimed and reseeded within one year of disturbance); the remaining 1,086 acres would be disturbed for the LOP.

Assuming the disturbance of dunal areas is proportional to the disturbance of the overall project area and that dunal areas occupy less than 1.00% of the J2PA, less than 22 acres (0.04% of the J2PA) and 11 acres (0.02% of the J2PA) would be affected by short-term and LOP disturbance, respectively. Removal of ground cover could result in reactivation of stabilized sand dunes, which could cause additional soil loss and decreased productivity; however, dunal areas would be avoided whenever possible. Therefore, disturbance to dunal areas would be considerably less than the abovementioned estimates.

Most soils in the J2PA have a naturally high erosion potential and generally have limited rehabilitation potential because of one or more characteristics, including thin soils, shallow depth to bedrock, excess salts, excess sand and/or small stones, clayey textures, and excess lime. Applicant-committed practices to protect soils include minimizing disturbance, avoidance of steep slopes, using best management practices for reclamation and revegetation (including the ripping of compacted soils), and preparation of SWPPPs (see Sections 2.4.11.5 and 2.4.11.6 and Appendix B). Experience gained from reclamation and revegetation in the Jonah EA area would be used to plan such activities in the J2PA to improve revegetation efficiency.

<u>4.1.5.2 Alternative A - Sensitive Resource Protection</u>

Implementation of Alternative A would result in the same types of impacts as the Proposed Action; however, surface disturbance would be reduced by approximately 6%, as 30 fewer well locations would be constructed, thereby reducing potential impacts to soils. Short-term and LOP disturbance to dunal areas as a result of Alternative A would be considerably less than 20 acres (0.03% of the J2PA) and 10 acres (0.02%), respectively.

<u>4.1.5.3 Alternative B - Maximum Location Density</u>

Implementation of Alternative B would result in the same types of impacts as the Proposed Action; however, surface disturbance would be reduced 21-23%, as 123 fewer well locations would be constructed, thereby reducing the opportunity for impacts to soils. Short-term and LOP disturbance to dunal areas as a result of Alternative B would be considerably less than 17 acres (0.03% of the J2PA) and 9 acres (0.02%), respectively.

<u>4.1.5.4 No Action Alternative</u>

Under the No Action Alternative, there would be no additional disturbance of soils other than that previously approved in the Jonah EA (BLM 1994b) and no additional disturbance of dunal areas. The DR and FONSI for the Jonah EA determined that that project would not have significant impacts on soils.

<u>4.1.5.5 Mitigation</u>

The BLM may require, as components of Surface Use Plans and/or Plans of Development, the inclusion of site-specific, predisturbance landscape characteristics, including soils, plant species composition, and plant cover data; and proposed reclamation seed mixes and application rates. In addition, special efforts to increase the likelihood of successful revegetation may include:

- the collection and analysis of soil samples from disturbed areas to determine appropriate reclamation seed mixtures and the need for soil amendments;
- the addition of fertilizers or other soil additives to improve soil texture and productivity;
- irrigation to improve germination and early growth; and/or
- topsoil stockpile seeding, mulching, or height reduction (to <3 ft) where topsoil is stockpiled for more than 3 months.

These measures may be applied as specified in APD and ROW application Surface Use Plans and/or Plans of Development. The BLM also may conduct quality assurance reviews to ensure compliance approved in APDs and ROWs.

The BLM may require Operators to avoid, where practical, Monte-Leckman complex, Huguston-Horsley-Terada complex, stabilized dune, and alkaline soils, where practical. In addition, the BLM may require Operators to restrict project-related travel on the J2PA roads during periods when soils are saturated and rutting could occur.

4.1.5.6 Cumulative Impacts

The CIAAs for soils consists of the four watersheds that drain the J2PA--Eighteen Mile, Sublette Flats, Long Island, and Expanded Waterhole Draw (Map 4.2). The Eighteen Mile watershed (134,700 acres [210.5 mi^2]) includes 1,280+ acres of existing disturbance, due almost entirely to roads and pipeline ROWs (Table 4.5). The Sublette Flats watershed (111,500 acres [174.2 mi^2]) contains 960+ acres of existing disturbance, again, primarily roads and pipeline ROWs. Existing disturbance in the Long Island watershed (186,200 acres [290.9 mi^2]) totals 3,840+ acres, and roads, pipeline ROWs, and agricultural lands are the major components. The Expanded Waterhole Draw watershed (212,100 acres [331.4 mi^2]) has the largest amount of existing disturbance (22,976 acres), 71.6% of which is agricultural lands. Reservoirs, roads, and pipeline ROWs comprise most of the remainder of existing disturbance in this watershed.

Long-term disturbance in the J2PA as a result of the Proposed Action would be 934 acres. Long-term disturbance associated with Alternatives A and B would be 878 and 724 acres, respectively. Most of the disturbance likely would occur in the Long Island Watershed (see Table 4.5).

RFD for the Eighteen Mile watershed is estimated at 401 acres, primarily due to 396 acres of gas-related disturbance associated with the Fontenelle/Lincoln Road projects (BLM 1995b). Operator-committed and BLM-required protection measures for soils in the Fontenelle/Lincoln Road projects are as restrictive as those proposed for this project. RFD for the remaining three watersheds is estimated at less than 10 acres each.

The maximum cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) would be 30,410 acres (4.7%) of the combined watersheds (Table 4.5). Under Alternatives A and B, this total would be reduced by 56 acres and 210 acres, respectively. Disturbance would remain greatest in the Expanded Waterhole Draw watershed (23,183 acres, or 10.9% of the watershed), and agricultural lands would continue to be the primary component of the disturbance. Maximum cumulative disturbance in the Long Island watershed is estimated at 4,478+ acres (2.4% of the watershed). Estimated maximum cumulative disturbance in the Eighteen Mile and Sublette Flats watersheds would be approximately 1,739+ acres (1.3% of the watershed) and 1,009+ acres (0.9%), respectively.

4.1.5.7 Unavoidable Adverse Impacts

Productivity of some disturbed soils would be reduced due to removal of vegetation, exposure of the soils, mixing of soil horizons, and increased susceptibility to wind and water erosion. Some increased soil loss through erosion would be unavoidable under all of the proposed development alternatives.

4.1.6 Water Resources

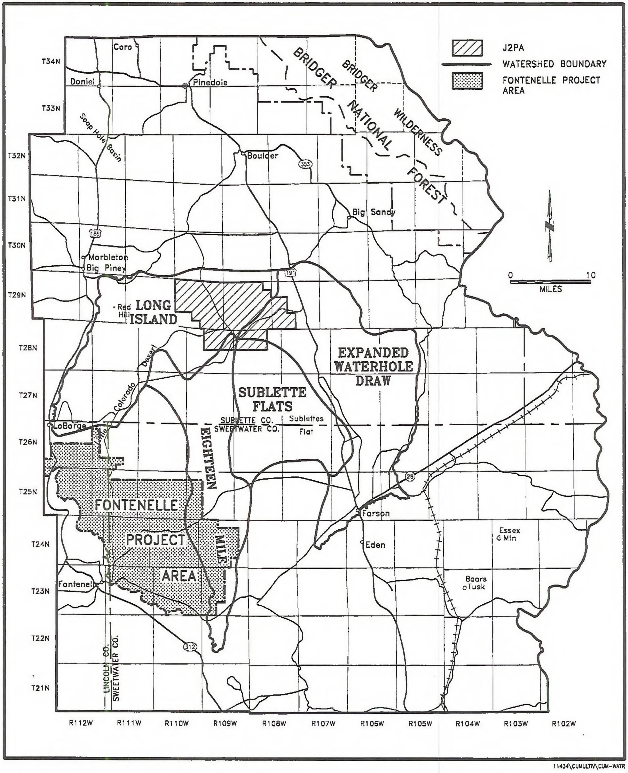
The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with water resources:

- to maintain or improve surface and groundwater quality;
- to protect, maintain, or improve wetlands, floodplains, riparian areas, and other water resources in the state; and
- to conserve water and to relate water resources and development to desired land use.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.1.6.1 The Proposed Action

Potential impacts to surface water resulting from the Proposed Action include increased turbidity, salinity, and sedimentation of surface waters due to runoff and erosion from disturbed areas; accidental spills of petroleum products or other pollutants; and discharge of unsuitable quality produced water and/or pipeline test water. Rates of wind and water erosion would increase above natural rates until successful reclamation of disturbed areas is achieved. There would be no depletion of surface waters associated



Map 4.2 Cumulative Impact Assessment Areas (Project-Affected Watersheds) for Soils, Surface Waters, Vegetation, and Fisheries, Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

Table 4.5 Maximum Acreage of Long-term Surface Disturbance in the Cumulative Impact Assessment Areas for Soils, Surface Water, Vegetation, and Wetland/Riparian Areas, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.[1]

Item	Total Existing Disturbance	Proposed Development: Proposed Action	Proposed Development: Alternative A[2]	Proposed Development: Alternative B[3]	RFD[4]	Maximum Total Cumulative Disturbance[5]
EIGHTEEN MILE						
Roads/pipeline ROWs	1,216	37	35	29	--	1,253
Oil/gas wells	Tr[6]	20	18	15	401	421+
Reservoirs	Tr	--	--	--	--	Tr
Dwellings	--	--	--	--	--	--
Agricultural lands	--	--	--	--	--	--
Other disturbance	64	1	1	1	--	65
Total	1,280+	58	54	45	401	1,739+
SUBLETTE FLATS						
Roads/pipeline ROWs	640	29	28	23	--	669
Oil/gas wells	Tr	15	14	12	4	19
Reservoirs	128	--	--	--	--	128
Dwellings	Tr	--	--	--	--	Tr
Agricultural lands	--	--	--	--	--	--
Other disturbance	192	1	1	1	--	193
Total	960+	45	43	36	4	1,009+
LONG ISLAND						
Roads/pipeline ROWs	1,408	404	380	316	--	1,812
Oil/gas wells	384	213	199	160	7	604
Reservoirs	192	--	--	--	--	192
Dwellings	64	--	--	--	--	64
Agricultural lands	1,664	--	--	--	--	1,664
Other disturbance	128	14	14	14	--	142
Total	3,840+	631	593	490	7	4,478+

Table 4.5 (Continued)

Item	Total Existing Disturbance	Proposed Development: Proposed Action	Alternative A[2]	Alternative B[3]	RFD[4]	Maximum Total Cumulative Disturbance[5]
EXPANDED WATERHOLE DRAW						
Roads/pipeline ROWs	2,048	127	120	99	--	2,175
Oil/gas wells	Tr	67	63	50	8	75+
Reservoirs	3,968	--	--	--	--	3,968
Dwellings	64	--	--	--	--	64
Agricultural lands	16,448	--	--	--	--	16,448
Other disturbance	448	5	5	5	--	453
Total	22,976	199	188	154	8	23,183+
TOTAL FOR ALL WATERSHEDS COMBINED						
Roads/pipeline ROWs	5,312	598	563	466	--	5,909
Oil/gas wells	384+	315	294	237	420	1,119+
Reservoirs	4,289+	--	--	--	--	4,289+
Dwellings	128+	--	--	--	--	128+
Agricultural lands	18,112	--	--	--	--	18,112
Other disturbance	832	21	21	21	--	853
Total	29,056	934	878	724	420	30,410+

1 Watershed areas are as follows: Eighteen Mile, 134,700 acres (210.5 mi²); Sublette Flats, 111,500 acres (174.2 mi²); Long Island, 186,200 acres (290.9 mi²); and Expanded Waterhole Draw, 212,100 acres (331.4 mi²).

2 Proposed LOP disturbance is assumed to be reduced from Proposed Action by approximately 6%.

3 Proposed LOP disturbance is assumed to be reduced from Proposed Action by 21-23%.

4 RFD = Reasonably foreseeable development as defined in Section 4.0 (i.e., an assumption of 0.023 acre of disturbance per mi² plus development described in the Fontenelle EIS/ROD [BLM 1996d]), if applicable to the area discussed).

5 Based on implementation of the Proposed Action.

6 Tr = less than 64 acres or 0.01% of the 644,480-acre cumulative impact assessment area.

with the Proposed Action and with successful reclamation, only a very minor amount, if any, project-related sedimentation would reach the Green River. Minimization of potential impacts to surface waters would be accomplished by implementing applicant-committed practices to ensure proper facility siting (including avoidance of riparian areas and floodplains), use of best management practices, and ensuring proper reclamation and revegetation (see Sections 2.4.11.5 and 2.4.11.6 and Appendix B). No impacts to and from flooding are anticipated, since flood-prone areas would be avoided, where practical.

A total of 152 acres of LOP-required disturbance exists in the J2PA at the present time--0.3% of the J2PA. The Proposed Action would result in an additional 934 acres of LOP disturbance, bringing the total to 1,086 acres, or 1.8% of the J2PA. An estimated 2,927 acres of new disturbance would be required for the Proposed Action. If surface disturbance is concentrated in any one watershed, potential erosion and runoff-related problems may occur, requiring the need for special treatments specified during the APD approval process.

Potential impacts to groundwater from the Proposed Action include consumption of water during drilling and completion, contamination of shallow aquifers from drilling and fracturing fluids and/or produced water, and potential impacts to deeper aquifers including cross-aquifer mixing through the well bore. Minimization of these potential impacts to groundwater would be accomplished by implementing applicant-practices described in Chapter 2.0 (see Section 2.4.11.6).

4.1.6.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would result in the same types of impacts as the Proposed Action; however, total new surface disturbance would be 3,073 acres (2,043 and 1,030 acres of short-term and long-term disturbance, respectively) and 30 fewer well locations would be constructed, thereby reducing the potential for impacts to surface water or groundwater. LOP disturbance to watersheds would increase from the existing 0.3% to 1.7%.

4.1.6.3 Alternative B - Maximum Location Density

Implementation of Alternative B would result in the same types of impacts as the Proposed Action; however, total surface disturbance would be 2,585 acres (1,709 and 876 acres for short-term and long-term disturbance, respectively) and 123 fewer well locations would be constructed, thereby reducing the potential for impacts to surface water or groundwater. LOP disturbance to watersheds would increase from the existing 0.3% to 1.5%.

4.1.6.4 No Action Alternative

Under the No Action Alternative, there would be no additional activities that would potentially affect water resources other than those previously approved in the Jonah EA. Some ephemeral drainages would remain prone to flooding after storm events, and their channels would continue to be subject to erosion at existing rates. The DR and FONSI for the Jonah EA determined that the project would not have significant impacts to water resources.

4.1.6.5 Mitigation

The Operators would cooperate with the BLM and the WDEQ-WQD to minimize impacts to all quality-impaired waters. In addition, the BLM may require the lining of all reserve pits and may require that drilling and/or fracturing fluids be hauled from locations and used for drilling or fracturing another well. The BLM also may require that all fracturing fluids flowed-back to the surface be contained in the tanks prior to their removal from locations.

4.1.6.6 Cumulative Impacts

The CIAAs for surface water includes all watersheds potentially affected by this project (Map 4.2)--the same CIAAs as for soils. The four watersheds total approximately 644,500 acres (1,007 mi^2), and 4.5% of the area has existing surface disturbance, primarily from agricultural lands, roads, and reservoirs. RFD for the Eighteen Mile watershed is estimated at 401 acres, primarily due to 396 acres of gas-related disturbance associated with the Fontenelle/Lincoln Road projects (BLM 1995b). RFD for the remaining three watersheds is estimated at less than 10 acres each.

The maximum cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) would be 30,410 acres (4.7%) in the combined watersheds (see Table 4.5). Under Alternatives A and B, this total would be reduced by 56 acres and

210 acres, respectively. Disturbance would remain greatest in the Expanded Waterhole Draw watershed (23,183+ acres, or 10.9% of the watershed), and agricultural lands would continue to be the primary component of the disturbance. Maximum cumulative disturbance in the Long Island watershed is estimated at 4,478+ acres (2.4% of the watershed). Estimated maximum cumulative disturbance in the Eighteen Mile and Sublette Flats watersheds would be approximately 1,739+ acres (1.3% of the watershed) and 1,009+ acres (0.9%), respectively.

The CIAA for groundwater is the J2PA. Pit lining, as necessary, and isolation of aquifers by cementing portions of the well bore would prevent groundwater contamination as described in Section 4.1.6.1.

4.1.6.7 Unavoidable Adverse Impacts

There would be an unavoidable increase in surface disturbance in watersheds within the J2PA for the LOP, as well as the use of groundwaters required for drilling and produced from wells during production.

4.1.7 Noise and Odor

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans do not specify any management objectives specifically associated with noise and odor. The following analyses show that the Proposed Action and alternatives are compatible with the BLM's general objective of preserving and maintaining the quality of the environment in the state in coordination with multiple use objectives. No significant impacts are anticipated.

Noise levels from project construction and operation depend on the loudness and pitch of the source, the listener's distance from the source, air temperature, humidity, turbulence, wind gradient, and screening effects from terrain and vegetation. Project-required activities would generate noise through wellpad, road, and pipeline construction, and flaring, drilling, facility operations, vehicle traffic, and site reclamation/ reconstruction.

4.1.7.1 The Proposed Action

Drilling rig and flaring operations would produce temporary noise levels of up to 115 dBA at the source, with noise levels of 55 dBA at 3,500 ft from the source (BLM 1991b); these activities are expected to be the loudest project-required noise-producing operations and would continue 24 hrs/day for approximately 20 days at each location. Increased noise levels associated with construction activities likely would range from 70 to over 90 dBA within 50 ft of the activity and would be associated with earthmoving equipment such as large trucks, scrapers, loaders, and graders. However, these noise levels also would be temporary and would attenuate with distance at a rate of approximately 6 dBA with each doubling of distance (Thumann and Miller 1986). These noise levels would be controlled with the applicant-committed practice of using proper operating techniques and maintenance of manufacturer-installed noise abatement equipment (see Section 2.4.11.7).

Compressor engines would generate about 92 dBA at 10 ft (55 dBA at 600-700 ft), and the air intakes 119 dBA at 3 ft (55 dBA at 3,000 ft). These noise levels are for unhoused and unmuffled compressors, and would be reduced through required controls by housing the compressors and by the installation of silencers on exhaust stacks. Compressor engine noise would occur throughout the LOP.

Noise levels associated with production operations at each wellpad would be minimal, since no pumping is required.

There are no humans residing within several miles of the J2PA; therefore, there would be no impacts to humans other than those persons in close proximity to construction, drilling, or compressor station activities--generally workers who would observe safety precautions associated with work activities in high noise areas. Potential impacts of noise to wildlife are discussed in Section 4.2.2.

Increased noise levels associated with drilling rigs, completion activities, and other construction equipment employed during peak activity periods would be short-term at any given location, but would continue throughout the LOP--especially during the first 10-15 years, when well locations would be developed. Increased noise from compression and traffic would continue throughout the LOP.

Odors present periodically at well and ancillary facility locations and along roadways could offend area users in the vicinity of emission sources. However, odors associated with drilling and production operations

would be dispersed by the wind and are not anticipated to adversely affect the majority of area users.

4.1.7.2 Alternative A - Sensitive Resource Protection

Noise and odors would be of the same type as in the Proposed Action. However, because there would be fewer well locations in Alternative A (420 as opposed to 450 in the Proposed Action), overall noise and odor impacts would be somewhat reduced. In addition, noise-sensitive locations on the J2PA would be further protected due to CSU restrictions in areas proximal to active raptor nests and sage grouse leks. Potential impacts of noise to wildlife are discussed in Section 4.2.2.

4.1.7.3 Alternative B - Maximum Location Density

Noise and odors would be of the same type as in the Proposed Action. However, because there would be fewer well locations in Alternative B (337 as opposed to 450 in the Proposed Action), both noise and odor impacts would be reduced considerably. Potential impacts of noise to wildlife are discussed in Section 4.2.2.

4.1.7.4 No Action Alternative

Under the No Action Alternative, there would be no additional noise or odors other than those resulting from actions previously approved in the Jonah EA. Noise and odors were not identified as resources of concern in the Jonah EA.

4.1.7.5 Mitigation

The BLM could required housing for compressors and mufflers/silencers on exhaust stacks.

Partial additional mitigation to reduce noise could be accomplished by remote monitoring of selected wells and by pipelining condensates and produced water to central collection points, thereby reducing the number of trips required to check and service well locations and associate traffice noise.

To further reduce impacts associated with odors, the BLM may require improved separator/dehydrator units and/or VOC capture systems at condensate tanks (see Section 4.1.1.5).

4.1.7.6 Cumulative Impacts

Neither noise nor odors would be likely to be detected more than 1 mi from the J2PA, and in most cases, would be confined within the J2PA because of attenuation (noise) and dispersion (odors). No significant cumulative impacts from noise or odor are anticipated.

4.1.7.7 Unavoidable Adverse Impacts

All of the action alternatives would result in some additional noise and odors in the J2PA. Most sources of noise above ambient levels would be short-term, and odors likely would be quickly dispersed by the wind.

4.2 BIOLOGICAL RESOURCES

4.2.1 Vegetation

The management objective for vegetation resources per the PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans is to maintain or enhance vegetation community health, composition, and diversity in order to meet watershed, wild horse, and wildlife resource management objectives and provide for plant diversity (desired plant communities) to meet livestock management, watershed, wild horse, and wildlife objectives. The following analyses show that the Proposed Action and alternatives are compatible with this management objective, and no significant impacts are anticipated.

4.2.1.1 The Proposed Action

Under the Proposed Action, 3,250 acres of new project-required disturbance would result in the removal of existing--and generally native--vegetation, representing approximately 5.5% of the J2PA. Two thirds of this disturbed area would be reclaimed and revegetated with native species shortly after disturbance, whereas the remaining third (1,086 acres, or 1.8% of the J2PA) would be removed for the LOP. All the potentially disturbed vegetation types are common throughout undisturbed portions of the J2PA as well as on surrounding lands. No uncommon or unique vegetation types would be removed. Of the 3,250 acres from which vegetation would be removed, 2,164 acres (66.7%) would be reclaimed and revegetated shortly (3 to 5 years) after disturbance.

These areas would produce less forage for a few years until revegetation is successful, at which time grasses and possibly forbs would become more dominant and likely would be more productive than prior to disturbance (see Section 4.5.2.1). Shrubs likely would take 20 years or longer to reach predisturbance productivity levels. Short-term disturbance would be spread over the 10-15 year development period and would be scattered throughout the J2PA in small parcels, so that relatively few areas of small size would be disturbed in any one year. After a few years, much of the disturbed land would be revegetated and producing forbs and grasses, so that at no time would the entire 3,250 acres be out of production. Assuming it would take 20 years for shrubs to attain predisturbance production, the entire 3,250 acres of project-required disturbance would be below predisturbance shrub production levels until shrubs are re-established on these areas.

A total of 1,086 acres (1.8% of the J2PA) of vegetation would be removed for the LOP due to those portions of well pads, roads, and other associated facilities that would not be reclaimed and revegetated until abandonment. Vegetation removal would not all occur during the first year; rather, it would increase each year during the first 10-15 years as additional development occurred, and then decrease each year as wells are abandoned and reclaimed. At the end of the LOP, most, if not all, roads constructed for the project would be reclaimed and revegetated; however, BLM system roads (e.g., Burma and Luman Roads) would remain in upgraded status.

Habitat suitable to the invasion of noxious weeds and other undesirable annuals would be created as a result of removal of existing vegetation.

4.2.1.2 Alternative A - Sensitive Resource Protection

Impacts resulting from Alternative A would be of the same type as for the Proposed Action; however, short-term and LOP disturbance would be reduced by approximately 6% as compared to the Proposed Action.

4.2.1.3 Alternative B - Maximum Location Density

Impacts resulting from Alternative B would be of the same type as for the Proposed Action; however, short-term and LOP disturbance would be reduced by 21-23% as compared to the Proposed Action.

4.2.1.4 No Action Alternative

Under the No Action Alternative, there would be no additional removal of vegetation other than that previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant impacts to vegetation as a result of that project.

4.2.1.5 Mitigation

Vehicular traffic or parking could be restricted outside the running surface of the road and the designated well location as approved in APDs and ROWs. In addition, traffic could be restricted on two-tracks unless soils are dry or frozen.

The BLM may request Operator assistance in the monitoring of reclaimed areas.

4.2.1.6 Cumulative Impacts

The CIAAs for vegetation are the entire watersheds affected by the proposed project (see Map 4.2)--the same CIAAs as for soils (Section 4.1.5.6) and surface water (Section 4.1.6.6). As stated in Section 4.1.5.6, the four watersheds total more than 644,500 acres (1,007 mi^2), and 4.5% of the area has had the native vegetation removed primarily as a result of agricultural development and road and reservoir construction. The principal RFD in these watersheds would result from additional natural gas-related development in the Eighteen Mile watershed associated with the Fontenelle/Lincoln Road natural gas development projects and would involve an additional 396 acres of LOP disturbance, increasing total long-term removal of native vegetation from 1,280 acres to 1,676 acres, or from 1.0% to 1.2% of the area. An additional 1,677 acres of short-term disturbance would occur as a result of the Fontenelle/Lincoln Road development; however, these areas would be reclaimed and revegetated according to BLM standards. Nearly all of the disturbance to vegetation would occur in common habitat types--low density sagebrush, high density sagebrush, and greasewood/saltbush complex (BLM 1995b). A small number of additional exploratory wells are also likely to be drilled in the area.

The maximum cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) would be 30,410 acres (4.7%) in all the watersheds combined (see Table 4.5). Under Alternatives A and B, this total would be reduced by 56 acres and 210 acres, respectively. Agricultural lands would remain the primary component of cumulative disturbance in the vegetation CIAA (59.6%, or 2.8% of the combined watersheds), followed by roads and pipeline ROWs (0.9% of the combined watersheds) and reservoirs (0.7% of the combined watersheds).

4.2.1.7 Unavoidable Adverse Impacts

The action alternatives would remove 4-5% of the vegetation from the J2PA, and would provide habitat conducive to the invasion of weeds.

4.2.2 Wildlife and Fisheries

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with wildlife and fisheries:

- to maintain, improve, or enhance the biological diversity of all plant and wildlife species while ensuring healthy ecosystems;
- to restore disturbed or altered habitat with the objective to attain desired native plant communities, while providing for wildlife needs and soil stability; and
- to conserve and develop recreational resources for the benefit of present and future generations.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

Impacts to wildlife would result from the direct loss of habitat due to removal of vegetation, displacement of wildlife due to disturbance by project activities and increased access to the area (construction, drilling, traffic, etc.), direct mortality due to project activities such as construction of roads and well pads, increased mortality due to poaching and harassment, and an increased likelihood of vehicle/animal collisions due to increased traffic. A wildlife monitoring/protection plan is included as Appendix D.

4.2.2.1 The Proposed Action

Pronghorn. Under the Proposed Action, vegetation would be removed from 3,250 acres of spring/summer/fall habitat due to the construction of well locations, roads, pipelines, and other facilities. This represents 0.1% of the 4,762 mi^2 of spring/summer/fall habitat in the Sublette Herd Unit. No pronghorn crucial habitats would be disturbed. Of the 3,250 acres from which vegetation would be removed, 2,164 acres (66.7%) would be reclaimed and revegetated shortly after disturbance; however, these areas would produce less forage for a few years until revegetation is successful, at which time grasses and possibly forbs would become more dominant and likely would be more productive than prior to disturbance (see Section 4.5.2.1). Shrubs likely would take 20 years or longer to reach predisturbance productivity levels. Short-term disturbance would be spread over the 10- to 15-year development period and would be scattered throughout the J2PA in small parcels, so that relatively few areas of small size would be disturbed in any one year. After a few years, much of the disturbed land would be revegetated and producing forbs and grasses to supply seasonal forage, so that at no time would the entire 3,250 acres be out of production. Assuming it would take 20 years for shrubs to attain predisturbance production, the entire 3,250 acres of project-required disturbance would have shrub production below predisturbance levels until shrubs become re-established. Applicant-committed practices to minimize impacts to pronghorn from loss of vegetative cover include minimization of vegetation removal and disturbance and prompt reclamation and revegetation of disturbed areas not required for LOP operations (see Section 2.4.11.8 [3, 4, 5, and 6] and Appendix B).

A total of 1,086 acres (0.04% of spring/summer/fall habitat in the Sublette Herd Unit) of vegetation would be removed from spring/summer/fall pronghorn habitat for the LOP due to those portions of well pads, roads, and other associated facilities that would not be reclaimed and revegetated until project abandonment. Vegetation removal would not all occur during the first year; rather, it would increase each year during the first 10-15 years as additional development occurred and then decrease each year as wells are abandoned and reclaimed. Previously cited applicant-committed practices would minimize impacts to pronghorn from LOP habitat removal.

In addition to the direct loss of habitat due to construction of wellpads, pipelines, roads, and associated facilities, disturbance from drilling activities and traffic would affect utilization of habitats immediately adjacent to these areas. Pronghorn have been found to habituate to increased traffic volumes (Reeve 1984) and heavy machinery as long as the machines move in a predictable manner. Deviation from the ordinary causes antelope displacement (Segerstrom 1982). Some unquantifiable amount of displacement of pronghorn would undoubtedly occur, resulting in reduced use of existing habitat. Highest levels of displacement likely would occur during the construction and drilling phases when human activities occur at their highest levels. Based on the few pertinent studies (Gusey 1986; Guenzel 1987; and Easterly et al. 1991), displacement likely would be about 0.5 mi. During the production phase of the project, pronghorn likely would become more habituated to equipment and facilities and would be more likely to use habitats immediately adjacent to wells and within reasonable distances of compressor stations. No pronghorn crucial habitats would be affected by project operations.

Increased mortality from vehicle/animal collisions is a potential direct impact that may occur due to increased traffic in the project area for the LOP. Increased access to big game range may increase legal and illegal harvest by providing additional opportunities for humans to come into contact with animals. On the other hand, some people may be deterred from poaching because of the greater access and likelihood of being observed by other area users. The Operators would implement policies to control poaching/harassment of wildlife (see Section 2.4.11.9 [8]) and to minimize animal/vehicle collisions (see Section 2.4.11.9 [2]).

Pronghorn move through the J2PA on their way to and from crucial winter habitats, and these movements may be hindered by the proposed project; however, because wells would be approximately 0.5 mi apart, it is unlikely that project development operations would prohibit pronghorn migration. In addition, there would be an undisturbed corridor (excluding the Luman Road) at least 1.0 mi wide between U.S. Highway 191 and the J2PA boundary.

Other mammals. Direct impacts to other mammals would include loss of animals during construction and a potential increase in mortality from vehicle/animal collisions. Most small mammal species are relatively tolerant of human activity and likely would experience reduced populations in direct proportion to the amount of habitat removed. This would be most likely true for species with relatively small home ranges (rodents, lagomorphs, etc.), and less applicable to more wide-ranging species such as coyote. Project impacts to small mammals would likely be masked by natural variations in populations due to weather, disease, and other natural factors. Total project-required surface disturbance represents 5.5% of the J2PA, and only a portion of this area would be disturbed at any one time. Rare habitats (e.g., wetlands or riparian areas) would be avoided, where possible, and applicant-committed practices to minimize impacts to wildlife would reduce impacts.

Raptors. The principal threat to raptors from project activities and associated increased human access is disturbance during nesting, and project activities, without further mitigation, could cause a decrease in the reproductive success of raptors at the three known ferruginous hawk nesting territories on and adjacent to the J2PA. This potential impact is not anticipated to be significant, and continued monitoring and protection measures as specified in Appendix D would be applied, as necessary, to further protect raptor nesting.

Factors potentially resulting in decreased raptor reproductive success from the presence of increased human activities in the area include nest and/or area abandonment; damage to eggs or young from frightened adults; overexposure of eggs or young to heat or cold; missed feedings; premature fledging; and increased predation. The potential for these impacts would be greatest during project construction (10-15 years), when human activity levels are greatest; the potential for these types of impacts would be reduced during production (40-50 years).

Applicant-committed practices include establishing a 0.5-mi radius buffer zone around active raptor nests (1.0 mi for ferruginous hawks) during the nesting season, as well as an 825-ft exclusion buffer around active raptor nests for development of facilities that require repeated human presence (see Section 2.4.11.9 [3]). Spatial and temporal buffer zones would provide seasonal protection of raptor nests from human activities. However, nothing would prevent development within the buffer zone, excluding the 825-ft exclusion buffer, outside of the nesting season,

and activities associated with this development (e.g., well maintenance actions, traffic) could disturb nesting raptors during subsequent nesting seasons. For this reason, buffer zones around active raptor nests during nesting periods may provide inadequate nest protection and result in reproductive failure at the three known ferruginous hawk nesting territories (see Section 3.3.2.3) and possibly at an additional number of unknown nesting territories. In addition, unoccupied, suitable raptor nesting habitat also would be unprotected, and as the area becomes fragmented by project facilities, the availability of alternate nest sites may become limited.

Tolerance to disturbance varies between raptor species and among individuals of the same species, and raptor nest disturbance and the associated decrease in reproductive success may not occur at all if project facilities are located outside of the line-of-sight of active raptor nests and/or other raptor protection measures are effective. However, ferruginous hawks are among the most sensitive raptor species to human disturbance.

Reduction in raptor prey species would be minimized by applicant-committed practices previously cited to minimize surface disturbance and to ensure timely reclamation and revegetation. Surface disturbance would be distributed over a minimum of three potential raptor foraging territories and would disturb less than 5% of the entire J2PA at any one time. Therefore, reductions in prey species abundance would be minimal and are not anticipated to adversely affect raptors.

Game birds. Applicant-committed practices to avoid surface disturbance within 0.25 mi of a sage grouse lek and restrict construction activities in suitable sage grouse nesting habitat within 2.0 mi of a lek during the breeding and nesting season (see Section 2.4.11.9 [3]) would reduce potential impacts to sage grouse to insignificant levels. Continued sage grouse monitoring and protection (see Appendix D) also would be applied to further reduce impacts to sage grouse leks. However, some disturbance of nesting sage grouse likely would occur. In addition, the 0.25-mi buffer may be inadequate to protect breeding grouse from noise impacts (e.g., individuals flushed from leks, failure of females to breed, lek abandonment), which could result in reduced breeding success. The locations of the eight known leks on and adjacent to the J2PA are assumed to represent optimal lek habitat on the area, and if impacts to leks are sufficiently great to cause lek abandonment and alternate lek sites are established, it is assumed that the new lek sites would occur in less than optimal areas, further resulting in decreased breeding success. As with raptor nests, site-specific situations vary, and the success in reducing impacts with standard mitigation measures (e.g., buffer zones) is variable.

Field development could reduce the value of some sage grouse winter habitat areas; however, suitable winter habitat to accommodate grouse would remain on and adjacent to the J2PA. Further definition of potential sage grouse impacts would be provided during annual inventory and monitoring as specified in Appendix D, and additional protection measures may be applied as necessary.

Mourning doves likely would not be impacted by the Proposed Action because of the low level of disturbance to their habitat, their inherent mobility, and the availability of suitable habitats on adjacent lands.

Other birds. Whereas nongame birds could be adversely affected by increased human activity in the project area, primary impacts would occur in direct proportion to the amount of a species' habitat that would be removed. Initial surface disturbance would be scattered throughout the J2PA in small parcels, would represent less than 5% of the project area, and would avoid rare habitats. Two-thirds of the disturbance would be short-term. Some increased mortality would be likely from vehicle/bird collisions as a result of increased traffic. Measures already described to mitigate surface disturbances and project activities would minimize impacts to nongame birds as well. Reserve, workover, or other pits potentially hazardous to birds would be netted to prevent bird access (see Section 2.4.11.9 [6]); however, if ponds containing hazardous materials were not netted, mortalities may result.

Amphibians and reptiles. Direct impacts to amphibians and reptiles likely would occur in direct proportion to the amount of their habitat disturbed. Total surface disturbance to the J2PA would be approximately 5.5% of the area and would be in relatively small areas scattered in time and space over the J2PA. Two-thirds of all disturbance would be short-term, and rare habitats (e.g., wetlands, riparian areas) would be avoided. There would also be an

increase in mortality due to increased traffic in the project area. Measures already described to minimize surface disturbances and ensure timely reclamation and revegetation would minimize project impacts to amphibians and reptiles.

Fisheries. There are no fisheries within the J2PA. Applicant-committed practices to control erosion and prevent spills of hazardous materials (see Sections 2.4.11.5 and 2.4.11.17, and Appendices B and C) would minimize the potential for impacts to fisheries in the Big Sandy, New Fork, and Green Rivers.

4.2.2.2 Alternative A - Sensitive Resource Protection

The implementation of Alternative A generally would have the same type of impacts to wildlife as the Proposed Action; however, surface disturbance would be reduced by approximately 6%, as 30 fewer well locations would be constructed. In addition to reducing surface disturbance, temporary displacement due to construction and development activities and from traffic would likely be reduced, although this would depend on the site-specific locations for the 420 well locations proposed.

The principal difference between Alternative A and the Proposed Action would be that under Alternative A there would be a CSU restriction denying surface occupancy for facilities requiring repeated human presence within 0.5 mi of active raptor nests and sage grouse leks. This would notably decrease the likelihood that raptors or sage grouse would be disturbed by project activities, and no impacts to the reproductive success of these species is anticipated under this alternative (i.e., the three known active ferruginous hawk nests and eight sage grouse leks would be protected from human disturbance and activities). In addition, the effectiveness of artificial nest structures, if employed, would likely remain intact, and raptor and sage grouse monitoring of the area would continue (see Appendix D).

4.2.2.3 Alternative B - Maximum Location Density

The implementation of Alternative B would have the same type of impacts as the Proposed Action; however, surface disturbance would be reduced by 21-23%, as 123 fewer well locations would be constructed. In addition to reducing surface disturbance, temporary displacement due to construction and development activities and from traffic would likely be reduced, and since well location densities likely would be reduced in some areas, impacts to species that are susceptible to high levels of human activity (e.g., nesting raptors) would be reduced as well. However, as with the Proposed Action, there is no assurance that raptor and sage grouse nesting habitat would be protected outside of the breeding/nesting season. The effectiveness of artificial nest structures for raptor protection likely would be maintained under this alternative due to decreased well densities, and raptor and sage grouse monitoring of the area would continue (see Appendix D).

4.2.2.4 No Action Alternative

Under the No Action Alternative, wildlife population levels would be determined primarily by natural forces such as weather, and, for game species, by WGFD regulations. There would be no additional man-caused impacts other than those previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant impacts to wildlife as a result of that project.

4.2.2.5 Mitigation

Additional water sources (e.g., retention of project-developed water wells) may be developed by the Operators in the J2PA to increase seasonal use of the area by pronghorn and sage grouse, or to hold pronghorn on the J2PA for longer periods during seasonal movements in order to reduce foraging pressure on crucial winter habitats, as deemed appropriate by the BLM in consultation with the WGFD.

Inventory and monitoring of wildlife on the J2PA would be conducted as specified in the Wildlife Monitoring/Protection Plan (see Appendix D), and appropriate management decisions would be made to further protect wildlife and their habitats. The BLM may require sage grouse nest surveys prior to disturbance for developments proposed within sage grouse nesting habitat. The BLM also may require the netting of all reserve pits.

4.2.2.6 Cumulative Impacts

Pronghorn. The CIAA for pronghorn is the spring/summer/fall range within the Sublette Herd Unit and migration corridors for the herd. The total area of cumulative disturbance to spring/summer/fall pronghorn range is unknown; however, this range type occupies 4,762 mi² (71%) of the 6,696 mi² of total occupied habitat in the herd unit and, since the WGFD population objective has been raised more than 100% in the last five years (from 19,400 pre-1992 to 30,000 in 1992, and 40,000 in 1994), it appears that such habitat is in adequate supply. The proposed project, including existing project-required disturbance, would involve 1,086 acres of habitat loss for the LOP, although the entire 1,086 acres would not be disturbed until approximately the 15th year of development, at which time some of the wells developed in earlier years would likely be through producing and abandoned, reclaimed, and revegetated, reducing LOP disturbance below the 1,086-acre level. RFD disturbance to spring/summer/fall pronghorn habitat would occur as a result of the Fontenelle/Lincoln Road projects and any exploratory oil/gas activity. Texaco's Stagecoach Draw natural gas development would not impact spring/summer/fall pronghorn habitat (BLM 1995c). The Fontenelle project would disturb approximately 996 acres for the LOP (BLM 1995b)--an additional 0.03% of the spring/summer/fall pronghorn habitat in the Sublette Herd Unit.

There are few serious impediments to Sublette Herd Unit pronghorn migration. There are some sheep-tight fences just north of Big Sandy Reservoir and east of U.S. Route 191 that need modifications to facilitate pronghorn crossing, as do fences 7 mi east of Farson along Highway 28 (personal communication, December 16, 1996, with Tom Christianson, Wildlife Biologist, WGFD, Green River). Fences along the Big Piney Cutoff road north of the J2PA, as well as other fences in the migration route, do not appear to pose serious obstacles to pronghorn migration (personal communication, December 16, 1996, with Doug McWhirter, Wildlife Biologist, WGFD, Pinedale). WGFD personnel would continue to monitor herd movements.

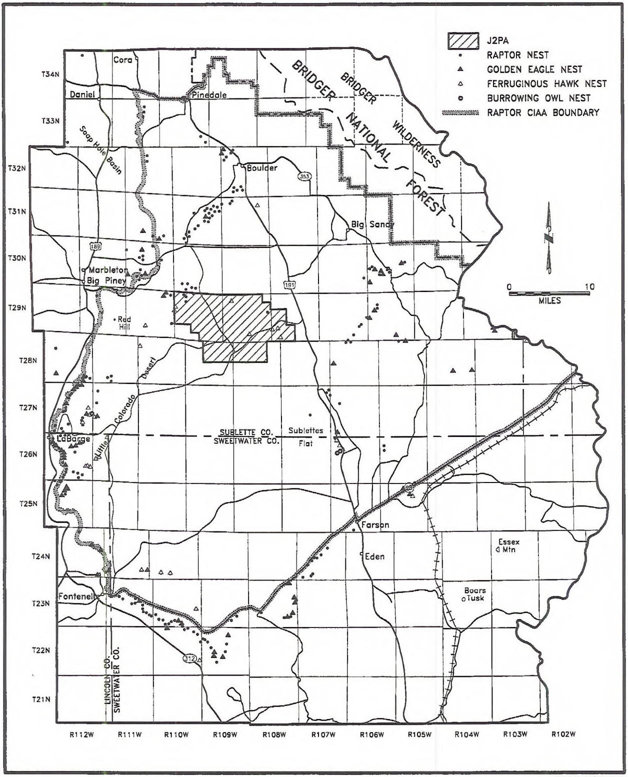
Other mammals. The CIAA for other mammals is the J2PA and a 2-mi buffer. There is little additional disturbance anticipated in the 2-mi buffer around the J2PA other than some road upgrades that would disturb relatively small areas adjacent to existing disturbance (see Appendix A) and impacts described in the Jonah EA (BLM 1994b). These would have impacts similar to those already described in Section 4.2.2.1.

Raptors. The CIAA for raptors encompasses 1,548,800 acres (2,420 mi²) and contains approximately 254 known raptor nests, including 68 golden eagle and 44 ferruginous hawk nests (Map 4.3). Existing surface disturbance includes approximately 67,520 acres (106 mi²), or 4.4% of the CIAA, and results primarily from agriculture and hayfields (56%) and roads and pipeline ROWs (22%) (Table 4.6). Project-related long-term disturbance would total 934 acres under the Proposed Action. Acreages associated with Alternatives A and B are slightly lower (878 and 724 acres, respectively).

Under implementation of the Proposed Action and Alternative B, the reproductive success of three known ferruginous hawk nesting territories could be impaired, potentially adding to reductions in the regional reproductive success of this species. With the implementation of Alternative A or the No Action Alternative, no additional impact to raptors is anticipated.

RFD disturbance in the CIAA includes 1,988 acres (3.1 mi²) associated with natural gas development described in the Fontenelle EIS (BLM 1995b) and 56 acres anticipated as a result of exploratory wells (see Section 4.0). Oil and gas development occurs primarily along the Green River from Bird Canyon south through Fontenelle. The Fontenelle DEIS (BLM 1995b) states that the area of concentrated raptor nesting along the Green River would not be affected and that other raptors would be protected, at least during the nesting season, by timing restrictions and spatial buffers.

The maximum total cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) anticipated within the raptor, recreation, and visual resource CIAA is 70,498 acres (110 mi²), or 4.6% of the CIAA, and most of this is existing (67,520 acres) (Table 4.6). Agricultural lands comprise the greatest portion of this disturbance (54% or 2.5% of the CIAA), followed by roads and pipeline ROWs (24% or 1.0% of the CIAA), reservoirs and residential areas (8% each or 0.4% of the CIAA each), oil/gas wells



Map 4.3 Regional Raptor Nest Locations, Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

Table 4.6 Long-term Surface Disturbance in the Cumulative Impact Assessment Area for Raptors, Recreation, and Visual Resources, Jonah II Field Natural Gas Development Project, Sublette County, Wyoming, 1997.[1]

Item	Total Existing Disturbance	Proposed Development				Maximum Total Cumulative Disturbance[5]
		Proposed Action	Alternative A[2]	Alternative B[3]	RFD[4]	
Roads/pipeline ROWs	14,912	598	561	460	1,066	16,576
Oil/gas wells	1,280	315	296	243	978	2,573
Reservoirs	5,632	--	--	--	--	5,632
Dwellings	5,824	--	--	--	--	5,824
Agricultural lands	38,080	--	--	--	--	38,080
Other disturbance	1,792	21	21	21	--	1,813
Total	67,520	934	878	724	2,044	70,498

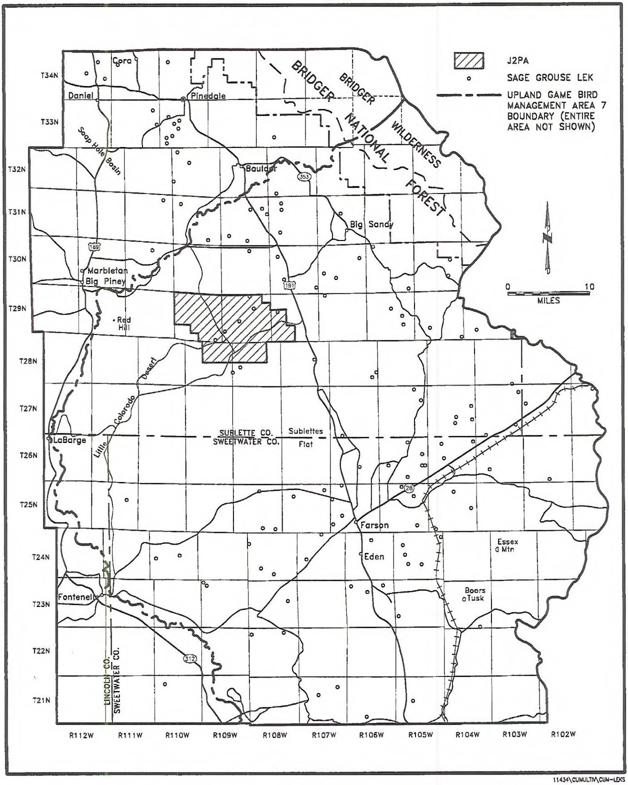
1 Cumulative impact assessment area for raptors, recreation, and visual resources totals approximately 1,548,800 acres (2,420 mi^2).
2 Proposed LOP disturbance is assumed to be reduced from Proposed Action by approximately 6%.
3 Proposed LOP disturbance is assumed to be reduced from Proposed Action by 21-23%.
4 RFD = Reasonably foreseeable development as defined in Section 4.0 (i.e., an assumption of 0.023 acres of disturbance per mi^2 plus development described in the Fontenelle EIS [BLM 1995c]), if applicable to the area discussed).
5 Based on implementation of the Proposed Action.

(4% or 0.2% of the CIAA), and other disturbance (3% or 0.1% of the CIAA).

Game birds. The CIAA for sage grouse is Upland Game Bird Management Area 7. Approximately 110 known sage grouse leks occur in the area, with concentrations south of Boulder and along the Highway 28 corridor (Map 4.4) (BLM 1987a, 1996a). The proposed project and RFD likely would result in some disturbance of nesting sage grouse, although the extent of that disturbance is unknown. The Fontenelle EIS suggests that that project could reduce the likelihood of use of up to 40,000 acres of existing habitat that presently exhibits probabilities of 50% or greater for providing suitable nesting habitat for sage grouse nesting habitat (BLM 1995b).

The CIAA for mourning dove is the project area and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the J2PA, other than some road upgrades and pipeline installation that would disturb relatively small areas adjacent to existing disturbance (see Appendix A), and impacts described in the Jonah EA (BLM 1994b). These would have impacts similar to those already described in Section 4.2.2.1.

Other birds. The CIAA for other birds is the project area and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the J2PA, other than some road upgrades and pipeline installations that would disturb relatively small areas adjacent to existing disturbance (see Appendix A), and impacts described in the Jonah EA (BLM 1994b).



Map 4.4 Regional Sage Grouse Lek Locations, Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

These would have impacts similar to those already described in Section 4.2.2.1.

Amphibians and reptiles. The CIAA for amphibians and reptiles is the project area and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the J2PA, other than some road and pipeline upgrades that would disturb relatively small areas adjacent to existing disturbance (see Appendix A), and impacts described in the Jonah EA (BLM 1994b). These would have impacts similar to those already described in Section 4.2.2.1.

Fisheries. The CIAAs for fisheries includes all project-affected watersheds (see Map 4.2), the same as for soils and surface waters. Affected drainages include Eighteen Mile Canyon Creek, Watershed Draw, Fogarty Draw, Alkali Creek, and Granite Wash, all of which are classified as Class 4 streams by WDEQ, and Waterhole Draw, which is a Class 3 stream (WDEQ 1990a). Class 3 streams are suitable for nongame fish only, whereas Class 4 streams do not have the hydrologic or natural water quality potential to support fish, but receive protection for agricultural uses and wildlife watering. Other minor or unnamed draws also occur that are not classified by WDEQ (1990a); however, these are ephemeral and are incapable of supporting fish populations.

As stated in Section 4.1.5.6, the four watersheds total approximately 644,500 acres (1,007 mi^2), and 4.5% of the area has existing surface disturbance, primarily from agricultural lands, roads, and reservoirs. RFD for the Eighteen Mile watershed is estimated at 401 acres, primarily due to 396 acres of gas-related disturbance associated with the Fontenelle/Lincoln Road projects (BLM 1995b). BLM-required measures for protection of surface waters in the Fontenelle/Lincoln Road project areas are as restrictive as those proposed in this project. RFD for the remaining three watersheds is estimated at less than 10 acres each.

The maximum cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) would be 30,410 acres (4.7%) within all watersheds combined (see Table 4.5). Under Alternatives A and B, this total would be reduced by 56 acres and 210 acres, respectively. Disturbance would remain greatest in the Expanded Waterhole Draw watershed (23,183 acres, or 10.9% of the watershed), and agricultural lands would continue to be the primary component of the disturbance. Maximum cumulative disturbance in the Long Island watershed is estimated at 4,478 acres (2.4% of the watershed). Estimated maximum cumulative disturbance in the Eighteen Mile and Sublette Flats watersheds would be 1,739 acres (1.3% of the watershed) and 1,009 acres (0.9%), respectively.

4.2.2.7 Unavoidable Adverse Impacts

Activities associated with the proposed project could interfere with successful reproduction of raptors and/or sage grouse if applicant-committed practices to protect these species are ineffective. If ponds containing hazardous materials are not netted to exclude birds, bird mortality may occur, and some mortality of wildlife likely would occur due to construction of facilities (wells and roads) and wildlife/vehicle collisions.

4.2.3 Threatened, Endangered, and Special Status Species

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with threatened, endangered, candidate, and sensitive species:

- to maintain or enhance essential species communities and important habitat and prevent destruction or loss of the plant species communities and important habitat;
- to provide opportunities for enhancing or expanding habitats of these species; and
- to prevent the need for listing these species as threatened or endangered.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.2.3.1 The Proposed Action

The Proposed Action would result in short-term disturbance of 2,164 acres and LOP disturbance of 1,086 acres (i.e., a total of 3,250 acres of new disturbance); however, this project is unlikely to adversely affect any T&E species potentially inhabiting the J2PA (see Appendix E). There is no suitable habitat for whooping crane and no suitable nesting habitat for bald eagle or peregrine falcon. Bald eagle and peregrine falcon may occasionally use the J2PA

for foraging, and most of the project area would remain available for such activity. Black-footed ferrets are unlikely to be present; however, should they be discovered in the J2PA, consultation would be initiated with the USFWS to ensure their protection and management. There would be no withdrawals of surface water, nor increased turbidity or sedimentation that would adversely affect the four species of endangered fish present in the Green and Colorado Rivers below Flaming Gorge Dam.

If mountain plover (a USFWS candidate species) use the J2PA for nesting, they could be disturbed by construction and drilling activities; however, applicant-committed practices would minimize this possibility (see Section 2.4.11.9 [13] and Appendices D and E). Although some potential nesting habitat could be disturbed, the extent of disturbance likely would be less than 5% of such habitat and would not be likely to jeopardize the species.

Surveys for other special status animal species would be conducted, if appropriate, prior to APD or ROW approval, and applicant-committed practices described in Section 2.4.11.9 [10, 11, 15, and 17] would minimize impacts to these species.

4.2.3.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as the Proposed Action; however, there would be approximately 6% less surface disturbance, as 30 fewer well locations would be developed.

4.2.3.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce the same type of results as the Proposed Action; however, there would be 21-23% less surface disturbance, as 123 fewer well locations would be developed.

4.2.3.4 No Action Alternative

Under the No Action Alternative, there would be no additional activities potentially affecting T&E or special status animal species other than those previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded that that project would be unlikely to adversely affect T&E species.

4.2.3.5 Mitigation

All potential habitat for Cedar Rim thistle would be surveyed prior to disturbance. This habitat includes barren slopes, fans, and draws on whitish-gray sandstone, chalk, tufaceous colluvium, or clay substrates.

4.2.3.6 Cumulative Impacts

The CIAA T&E, candidate, and other species of concern is the entire range of the species under consideration. Cumulative impacts to federally listed species are discussed in the BA (Appendix E) and summarized here. Past surface-disturbing activities have reduced the amount of habitat available to these species, as have other land uses. Cattle grazing, agriculture, a federal highway system and other roads, towns and residences, Fontenelle Reservoir, the clearing of land of trees and shrubs, and pesticide and herbicide use all have contributed to habitat losses and impacts on these species. Construction of Fontenelle Reservoir and agriculture in the Green River bottomlands have accounted for most of the loss of wetland habitat and the species associated with wetlands. Open water created by Fontenelle Reservoir probably has benefited some species of concern, such as bald eagle.

No impacts to the endangered black-footed ferret are anticipated since none are known to inhabit the J2PA. It is likely that past activities in the general area of the J2PA have had adverse impacts on ferrets, primarily by controlling prairie dog populations.

No populations of bald eagles, nor their nests and winter roosts, are known to occur in the J2PA, and it is unlikely that they ever did. Bald eagles use the Green River corridor for migration, and may occasionally forage in the J2PA; however, large areas would remain available for such activity, including most of the J2PA. RFD would avoid disturbance along the Green River and in the vicinity of known nests and winter roosts and would be unlikely to adversely affect bald eagles.

Peregrine falcon are not known to frequent the J2PA but, like bald eagles, they do use the Green River as a spring/fall migration corridor. Peregrine falcon may rarely use the J2PA for foraging, but even this is unlikely because waterfowl--a primary prey--are uncommon in the J2PA. Therefore, it is unlikely that

the proposed project would adversely affect peregrine falcon or increase cumulative impacts to this species associated with other projects.

Whooping crane also use the Green River as a spring/fall migration corridor; however, no suitable habitat for this species occurs within the J2PA. Therefore, it is unlikely that the project would adversely affect whooping crane or add to cumulative impacts associated with other projects.

The proposed project would be unlikely to adversely affect the four endangered fish species that occur in the Green/Colorado River drainage below Flaming Gorge Dam, nor would it be likely to add to cumulative impacts associated with other projects. These fish species have been impacted by past changes in river flows--both qualitative and quantitative--due to water withdrawals and reservoir construction and operations. No surface water depletions would result from this proposed project, and water depletions due to actions recommended in the Fontenelle ROD would require payment of a depletion fee to the USFWS Colorado River Endangered Fish Recovery Program.

Mountain plover have not been observed in the J2PA or immediately adjacent areas (WGFD 1996b); however, they are known to breed in the general vicinity of the J2PA (Dorn and Dorn 1990; WGFD 1992), and some suitable breeding and foraging habitat does occur on the J2PA. Nesting habitat would be surveyed during the nesting season prior to construction, and construction would be delayed if a nesting mountain plover or a brood was found. Therefore, the proposed project would not be likely to jeopardize mountain plover or add to cumulative impacts associated with other projects.

Cumulative impacts to species of concern and state sensitive species would be minimal because of the relatively small amount of habitat that would be disturbed by the proposed project and RFD.

4.2.3.7 Unavoidable Adverse Impacts

A small portion of the J2PA would no longer be available as foraging habitat for bald eagle or peregrine falcon, or for nesting habitat for mountain plover.

4.2.4 Wild Horses

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with wild horses:

- to protect, maintain, and control viable, healthy herds of wild horses while retaining their free-roaming nature;
- to provide adequate habitat for free-roaming wild horses through management consistent with environmental protection; and
- to provide opportunity for the public to view wild horses.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.2.4.1 The Proposed Action

Implementation of the Proposed Action would temporarily displace wild horse bands from areas subject to disturbance. Displacements as a result of surface disturbance would constitute a direct, short-term impact. Adequate habitat exists adjacent to the areas of disturbance to accommodate the horses for short periods of time. The direct removal of habitat as a result of surface disturbance due to wells, roads, and pipelines would be minimal, since less than 1% of the 519,541-acre Little Colorado Desert Interim WHHMA is included in the J2PA, and only 5% of this 1% would be disturbed. Seed mixtures for revegetation in the GRRA would contain forbs and grasses especially palatable to wild horses, and these would benefit horses along reclaimed pipeline ROWs and reclaimed portions of well pads (see Appendix B). There could be an increase in the potential for vehicle/wild horse collisions: however, such collisions are expected to be rare and would be partially mitigated by applicant-committed practices imposing speed limits (see Section 2.4.11.9 [2]). Movement of wild horses across resource area boundaries would be prevented by maintenance of cattleguards within the transportation network--especially cattleguards separating the GRRA from the PRA (see Section 2.4.11.10 [1]).

4.2.4.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as the Proposed Action; however, there would be approximately 6% less surface disturbance.

4.2.4.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce the same type of results as the Proposed Action; however, there would be 21-23% less surface disturbance.

4.2.4.4 No Action Alternative

Under the No Action Alternative, there would be no additional actions potentially affecting wild horses other than those previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts to wild horses as a result of that project.

4.2.4.5 Mitigation

No additional mitigation is identified.

4.2.4.6 Cumulative Impacts

The CIAA for wild horses is the Little Colorado Desert Interim WHHMA, which is generally bounded on the south by the Big Sandy River, on the north by the GRRA boundary, on the west by the Green River, and on the east by U.S. Route 191. Other developments in this area generally are limited to secondary roads and natural gas development--especially the Fontenelle and Lincoln Road developments--southwest of the J2PA. Present and RFD activities are unlikely to reduce the carrying capacity of the Little Colorado Desert Interim WHHMA, although shifts in distribution may occur. However, wild horses habituate to human disturbance, especially vehicular traffic. The primary factor limiting the distribution of wild horses in the herd unit is the availability of water. The aesthetic values associated with viewing wild horses decline when the animals are observed in a viewshed that has been modified by oil/gas field development.

4.2.4.7 Unavoidable Adverse Impacts

The action alternatives would result in the loss of a small amount of wild horse habitat due to the construction of wells, roads, and pipelines.

4.3 CULTURAL RESOURCES

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with cultural resources:

- to design cultural resource management actions to maintain the value of cultural resources;
- to expand the opportunities for scientific study and educational and interpretive uses of cultural resources;
- to protect and preserve important cultural resources or their historic record for future generations;
- to resolve conflicts between cultural resources and other resource uses; and
- to conserve and develop historic resources for the benefit of present and future generations.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.3.1 The Proposed Action

Because of the requirement for compliance with Section 106 of the NHPA and with the ARPA on federal lands, all areas on federal lands (surface and mineral estate) proposed for surface disturbance would be surveyed for cultural resources (see Section 2.4.11.11 [1]). Procedures for identifying and protecting cultural resources on State of Wyoming lands are not in place. Once federal access via a ROW or other federal permit to the state lands boundary is obtained, noninventoried construction, project development, and site disturbance could occur.

While inventory and avoidance strategies will ensure no effect to cultural resources recognized and located during standard pedestrian inventory, sites not so recognized could be damaged or destroyed. Such unexpected discoveries would be handled on a case-

by-case basis pursuant to existing treatment or discovery plans or programmatic agreements. Lacking site-specific plans or agreements, discoveries are managed under the general direction of 36 CFR 800.11. Consultation involves the applicant, the Wyoming SHPO, the Advisory Council on Historic Preservation, and interested parties (see Section 2.4.11.11 [2]).

Unexpected Discoveries. Unexpected discoveries involve nonpredicted location of and impact to cultural resources (predominantly archaeological resources), usually occurring during initial heavy equipment surface disturbance activity. Such discoveries can become difficult to manage, as time constraints, degree of impact, legally required consultation, cost factors, and a poorly understood resource contribute to a complicated situation. Several past energy development projects in the Jonah Field have encountered unexpected discoveries. While most have been resolved with facility, others still await evaluation and mitigation. Unexpected discoveries become problems only if adequate protection plans are not in place.

Occurrence of unexpected discoveries is heightened in newer development areas (like the J2PA), where knowledge of soils and geomorphology is limited. This, coupled with a poor understanding of the nature and presence of undetected cultural material and overall buried site potential, contributes to the frequency and severity of encountering unexpected discoveries.

Field techniques likely to minimize discoveries include evaluative testing in "nonsite" sensitive soil areas; use of remote sensing techniques such as magnetometer survey, soil resistivity, or ground-penetrating radar; traditional subsurface hand evaluations; and construction monitoring. In the past, magnetometer inventory, monitoring of construction, and open pipeline trench examinations were the primary tools used to locate unexpected sites. Programmatic agreements and treatment or discovery plans can direct the specific management of affected cultural resources, reducing consultation timeframes, expediting management decisions and development, and adequately assuring the appropriate management of affected sites.

Native American TCPs and sensitive sites are managed subsequent to consultation among BLM, the potentially affected tribal representatives, SHPO, Operators, and other interested parties (see Section 2.4.11.11 [3]).

The proposed project could increase the potential for damage to cultural resources by illegal artifact collecting due to increased human presence in the J2PA. This presence is exacerbated by increased road construction, oil field and ancillary activity, and ease of access to and within the project area.

In areas considered sensitive to cultural resources, construction of well pads, pipelines, and access roads when the ground is frozen creates management concerns. When sites are located, discovered, or impacted during this type of construction, recordation, evaluation, and effect determination are difficult.

As the project develops in the eastern portions of the J2PA, conflicts with the Rock Springs to New Fork Wagon Road (Site 48SU1408, NRHP eligible) may develop. However, unlike the Oregon Trail system routes (i.e., routes where visual and other impacts are restricted within a 0.5-mi wide protective corridor), this Expansion Era wagon road is considered less sensitive.

4.3.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would have similar impacts to those of the Proposed Action; however, there would be less likelihood of encountering cultural resources due to a reduction in the extent of surface disturbance by approximately 6%.

4.3.3 Alternative B - Maximum Location Density

Implementation of Alternative B would have similar impacts to those of the Proposed Action; however, there would be less likelihood of encountering cultural resources due to a 21-23% reduction in surface disturbance.

4.3.4 No Action Alternative

Under the No Action Alternative, there would be no additional surface disturbance other than that already approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts to cultural resources as a result of that project. Illegal collecting likely would continue at present rates.

4.3.5 Mitigation

Energy development of the J2PA potentially could create adverse effects to NRHP eligible cultural resources. The primary tool for the mitigation of the adverse effect is avoidance, either by project redesign or relocation. This strategy is proposed for all recognized eligible sites, areas of Native American concern, and other recognized sensitive areas, specifically Sand Draw. However, avoidance would not always be possible.

Adverse project effects that cannot be eliminated via avoidance would be mitigated either on a case-by-case basis or via pre-established methods (Figure 4.1). For prehistoric sites whose importance is derived because of the data they contain, mitigation usually takes the form of data recovery via excavation. Unexpected discoveries similarly are treated via salvage excavations of impacted materials.

The standard mitigation of potential effects to TCPs and areas considered sensitive to Native Americans usually is avoidance. The specifics of avoidance (distances, buffers) is determined subsequent to consultation.

The Operators and BLM could initiate an educational program to inform J2PA employees and visitors about regulations concerning cultural resource management and artifact collection. Interpretive and informative signing could be implemented at the major road access points entering the J2PA.

Construction in archaeologically sensitive areas during frozen ground conditions could be prohibited. Construction operations could be planned to take advantage of the summer and fall construction windows, such that drilling could occur during winter.

Mitigation of effects to significant historic period cultural resources would be determined subsequent to consultation, recognizing the applicable significance criteria (36 CFR 60.4 [a] to [d]).

Programmatic agreements, discovery plans, and/or individual project treatment plans could be developed to reduce impacts on cultural sites.

Geoarchaeological studies could be incorporated into these plans where appropriate.

4.3.6 Cumulative Impacts

The CIAA for direct and indirect impacts to cultural resources is a 466-mi^2 (297,920-acre) area including the J2PA and the surrounding area (see Map 4.1). Existing disturbance in the CIAA comprises 3,132 acres (1.1% of the CIAA), most (66.9%) of which is roads and pipeline ROWs (see Table 4.4). Currently, the activities approved in the Jonah EA (BLM 1994b) are the only existing oil and gas activities in the area which have both direct and indirect effects on cultural resources. Cattle trampling is an indirect effect, while illegal artifact collecting is both a direct (frequently severe) and indirect effect on cultural resources. Severe impact to a site was documented in 1996, including both extensive artifact collecting and severe damage to at lease one stone circle. LOP disturbance potentially creating direct effects as a result of the Proposed Action, Alternative A, and Alternative B, would be 934, 878, and 724 acres, respectively (see Table 2.1). RFD disturbance, as defined in Section 4.0, would include an additional 11 acres of long-term disturbance from new natural gas exploration activities in the CIAA. Therefore, the maximum cumulative disturbance would be 4,077 acres (1.4% of the CIAA) (see Table 4.4).

The implementation of applicant-committed practices previously described would reduce impacts to cultural resources in the J2PA. Improvement of the Luman and Burma Roads, coupled with construction of numerous new roads, would increase access to the CIAA. Overall, increased human presence in the CIAA could result in increased cumulative impacts over the LOP. Because many of these impacts are indirect, they are difficult to minimize or mitigate.

4.3.7 Unavoidable Adverse Impacts

Some unavoidable adverse impacts to cultural resources would invariably occur due to the intensity of the development proposed, the poorly understood geoarchaeology of the area, and individual projects like routine road maintenance, rehabilitation, and reclamation efforts. Loss of the historic land use pattern of the J2PA for the LOP and until adequate reclamation is achieved would be unavoidable.

Unmitigated adverse effects to eligible sites could occur on state lands.

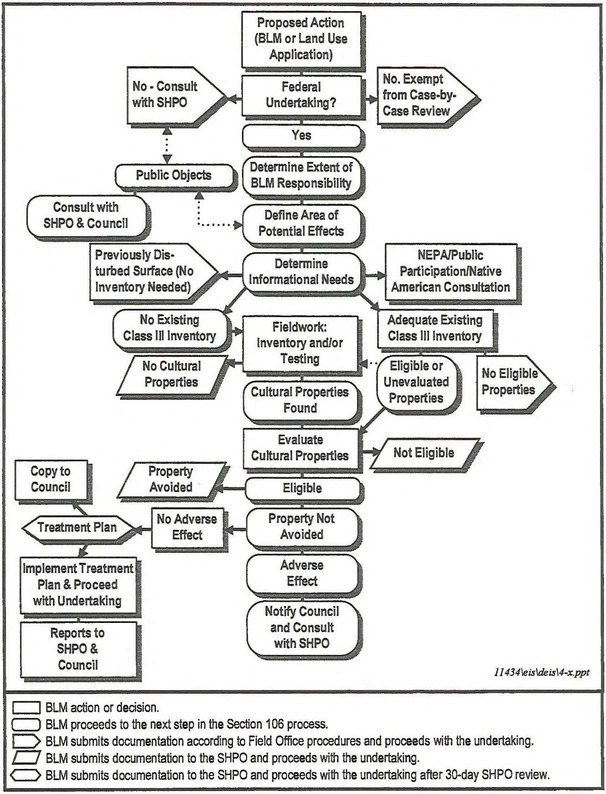


Figure 4.1 BLM/SHPO Programmatic Agreement Flow Chart, Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

4.4 SOCIOECONOMICS

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with socioeconomics:

- to coordinate land use decisions with economic factors and needs;
- to mitigate economic, social, and environmental impacts on communities caused by rapid or large-scale growth and development;
- to plan for the provision of public facilities and services, including safe and efficient transportation and utility systems, in coordination with local land use policies, goals, and objectives; and
- to provide adequate, suitable land to meet housing needs of all residents.

The following analyses show that the Proposed Action and Alternatives A and B are compatible with these management objectives, and no significant environmental impacts are anticipated. However, the generation of additional revenues would be beneficial and significant. The No Action Alternative would deny the beneficial affects of increased employment, economic activity, and substantial federal, state, local, and county revenues; therefore, this alternative would not be in accord with BLM, state, and local land use plans, and a significant negative impact on socioeconomics could occur.

4.4.1 The Proposed Action

Population changes in Sublette County due to the project would be negligible and of relatively short duration. There would be increased opportunities for local employment, both directly as a result of increased job opportunities associated with the proposed project and indirectly, as a result of increased economic activity.

It is estimated that the Proposed Action would provide 2,039 worker-years of employment during the LOP, over half of which (1,204 worker-years) would occur during the first 10 to 15 years of the project as wells are drilled and completed. Approximately $99 million of the estimated $495 million required for construction, drilling, and completion of the 450 proposed well locations would be for worker salaries (i.e., $6.5-$10 million per year during the 10-15 years of project development). An additional $38 million in salaries are estimated to be paid during the remaining 25 to 40 years of the project (i.e., $1.0-$1.5 million per year). Assuming an earnings multiplier of 1.778 (BLM 1997a), the total annual income effect in Wyoming would be an estimated $244 million for the LOP ($176 million during project development and $68 million during production). The mining industry, which includes natural gas production, pays the highest average wage of any industry group in Sublette County.

Fifty to 60 workers would be involved in construction, drilling, and completing a well, and the Operators propose utilizing up to four drilling rigs at any given time. With appropriate development planning (e.g., location construction outside winter period, drilling and construction of wells at locations away from sensitive wildlife areas during seasonal restriction periods), no seasonal reductions in the required workforce are anticipated. It is estimated that approximately 30 wells would be drilled and completed each year during project development. A maximum of about 200 workers may be required at any one time during the initial 10-15 years of project development if four construction crews, four drilling rigs, and four completion crews were operating simultaneously. From 20 to 30 workers would be required annually during the production phase of this project (25 to 40 years).

Construction workers would be local, whereas drilling and completion workers could be both local and transient; however, it is likely all would be from Sublette, Lincoln (LaBarge area), or Sweetwater (Rock Springs) Counties. It is not possible to determine where transient workers would live, but local drill crews would, by definition, already reside in the areas. Transient workers likely would occupy temporary housing in Pinedale or the Big Piney/Marbleton/LaBarge area, where housing would be available for the relatively few transient workers.

Local communities would experience increased economic activity through an increase in consumption of local goods and services. Earthwork on well locations and roads is usually contracted to local construction companies, and it is likely that even transient employees would spend some of their payroll in these communities. Sales tax revenues would increase as a result of increased retail sales. Much of

this activity would occur during well development, but benefits would continue throughout the LOP.

The project would generate substantial revenues for the U.S., state, county, and local governments, including school districts, through ad valorem taxes, severance taxes, federal royalties, and other taxes on facilities and production. It is estimated that, during the first 10 years of operations, gross income from the production of 617,610 mmcf of natural gas and 4,940 million bbl of condensate produced from the J2PA would be $1,035.2 million (Table 4.7). Of this gross revenue, $129.5 million would be paid in federal royalties (half of which is returned to the state), $54.4 million in state severance tax, $58.8 million in ad valorum tax on production, and $543,000 in conservation tax to pay for administration of the WOGCC. In addition, property tax revenues would increase due to the increased tax base resulting from capital improvements in the field, and drilling activities and the purchase of project-associated equipment and supplies would provide additional sales tax monies to the state and county.

Based on the 1995 allocation of Wyoming's share of federal mineral royalties, the approximately $65 million generated during the first 10 years of the project would be distributed to the Wyoming School Foundation Program ($26 million); the Highway Fund ($15 million); Capital Construction for Cities, Towns, Counties, and Special Districts ($6 million); Cities and Towns ($5 million); University of Wyoming ($4 million); Legislative Royalty Impact Account ($3 million); Highway Fund for County Roads and State Aid to County Roads ($3 million); School Districts Capital Construction ($2 million); and $1 million to other accounts. The $54.4 million in state severance taxes generated during the first 10 years of the project would provide funding for state highways, water developments, the Wyoming School Foundation, community colleges, and general state government. Ad valorum taxes on production (an estimated $58.8 million during the first 10 years of the project) would be distributed within Sublette County based on mill levy allocations, with the primary recipients being the Sublette County school districts, the School Foundation Program, county government, Weed and Pest Control, and the county library.

4.4.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would have the same type of results as the Proposed Action; however, economic benefits likely would be reduced because 30 fewer well locations would be developed. Impacts during the first 10 years would likely remain much the same as in the Proposed Action; however, over the LOP, there would be an approximately 6.7% reduction in gas and condensate production and corresponding reductions in revenues, royalties, taxes, and salary payments and associated income effects.

4.4.3 Alternative B - Maximum Location Density

Implementation of Alternative A would have the same type of results as the Proposed Action; however, economic benefits would be reduced because 123 fewer well locations would be developed. Impacts during the first 10 years likely would remain much the same as in the Proposed Action; however, over the LOP, there would be an approximately 27.3% reduction in gas and condensate production and corresponding reductions in revenues, royalties, taxes, and salary payments and associated income effects.

4.4.4 No Action Alternative

Under the No Action Alternative, the economic benefits of the action alternatives (see Sections 4.4.1, 4.4.2, and 4.4.3) would not be realized, and adverse significant impacts could occur by foregoing revenue generation. The economic benefits described in the Jonah EA (BLM 1994b) would be realized. The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts as a result of that project to the local housing market and that the project would generate $6.34 million in severance taxes and $13.3 million in federal royalties.

4.4.5 Mitigation

The BLM could encourage Operators to plan proposed development operations such that seasonal restrictions do not impart a roll-back in the level of development and associated workforce restrictions.

4.4.6 Cumulative Impacts

The CIAA for socioeconomics is Sublette County and affected communities, which include LaBarge in

Table 4.7 Estimated Natural Gas and Condensate Production, Gross Revenues, and Production Taxes Generated During the First Ten Years, Jonah Field II Natural Gas Development Project, 1997.

Year	Condensate Production (mbo)[1]	Gas Production (mmcf)	Gross Revenues[2] ($ millions)	Federal Royalty Payment[3] ($ millions)	State Severance Tax[4] ($ millions)	Ad Valorem Tax[5] ($ millions)	Conservation Tax[6] ($ thousands)	Total Payment ($ millions)
1	189	23,610	39.6	5.0	2.1	2.2	20.8	9.3
2	295	36,930	61.9	7.7	3.3	3.5	32.5	14.5
3	375	46,890	78.6	9.8	4.1	4.5	41.3	18.4
4	440	55,050	92.3	11.5	4.8	5.3	48.5	21.6
5	497	62,070	104.0	13.0	5.5	5.9	54.6	24.5
6	546	68,280	114.4	14.3	6.0	6.5	60.0	26.9
7	591	73,860	123.8	15.5	6.5	7.0	65.0	29.1
8	632	78,990	132.4	16.6	6.9	7.5	69.0	31.1
9	670	83,760	140.4	17.6	7.4	8.0	73.7	33.1
10	705	88,170	147.8	18.5	7.8	8.4	77.6	34.8
Total	4,940	617,610	1,035.2	129.5	54.4	58.8	543.0	243.3

[1] mbo = million bbl condensate.
[2] Well head price = $1.50/mcf for natural gas and $22/bbl for condensate.
[3] Gross revenues x 0.125.
[4] Gross revenues minus federal royalties x 0.06.
[5] Gross revenues minus federal royalties x 0.065.
[6] Gross revenues minus federal royalties x 0.0006.

Lincoln County and, to a lesser extent, Rock Springs in Sweetwater County. These counties depend on the oil and gas industry for a significant portion of their economic activity, and the proposed project would provide employment opportunities for the core of industry workers who already reside in the area and depend on continued oil/gas activity for a livelihood. RFD, especially from activity described in the Fontenelle EIS (BLM 1995b), would provide additional employment opportunities for Sublette/Sweetwater County residents. That activity also would utilize primarily local workers and would add significant monies to the local economy, the tax base, and to county, state, and federal revenues. Some temporary housing accommodations in the Rock Springs area could be exacerbated during the summer (BLM 1995b), but adequate temporary housing would be available for workers in the J2PA in Pinedale and the Big Piney/Marbleton/LaBarge area.

4.4.7 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to socioeconomics as a result of the proposed project.

4.5 LAND USE

4.5.1 Status/Use

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with land use/status:

- to manage public lands to support the goals and objectives of other resource programs;
- to respond to public demand for land use authorizations;
- to acquire administrative and public access, where necessary;
- to maintain or improve the quality of land resources in the state;

- to coordinate land use decisions with economic factors and needs;
- to provide for a cooperative process of local land use planning with other governmental agencies;
- to plan for continuing use of agricultural-rural lands and for potential changes in use of these lands;
- to plan land use consistent with the orderly development, use, and conservation of renewable and nonrenewable natural resources;
- to plan for the provision of public facilities and services, including safe and efficient transportation and utility systems, in coordination with local land use policies, goals, and objectives; and
- to minimize conflicts among utility corridor needs, competing land uses, and local land use plans.

The following analyses show that the Proposed Action and Alternatives A and B are compatible with these management objectives, and no significant impacts are anticipated. The No Action alternative would not be in accord with BLM, state, and local land use plans, since it would deny the orderly exploration, development, and use of oil and gas reserves available in the area. Therefore, the No Action Alternative would result in a significant negative impact on land use.

4.5.1.1 The Proposed Action

Under the Proposed Action, the ownership of surface and mineral estates in the J2PA would be unchanged. The current land use of livestock grazing, natural gas production, wildlife habitat, and recreation--primarily hunting--would continue during the LOP, although there would be increased emphasis on natural gas production. The historic land use pattern of the J2PA has been open land grazing. Development of the J2PA for petroleum extraction would alter, for the LOP and until reclamation is adequate, the historic land use pattern. There is the potential for some impacts to existing roads on the area if these roads are not adequately upgraded prior to their use for the project (see Appendix A). Natural gas recovery would become a dominant use of the J2PA, changing the character of the landscape from a relatively undisturbed area to one with industrial development; however, other existing uses would not be excluded as defined in Section 103(1) of FLPMA. After the LOP, land use likely would revert to livestock grazing, wildlife habitat, and recreation.

4.5.1.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as for the Proposed Action; however, there would be approximately 6% less surface disturbance.

4.5.1.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce the same type of results as for the Proposed Action; however, there would be 21-23% less surface disturbance.

4.5.1.4 No Action Alternative

Under the No Action Alternative, there would be no change in land ownership, and other land uses would continue much as at the present time.

4.5.1.5 Mitigation

Where proposed roads would follow existing roads, those portions of existing roads not included in the new road ROW and not needed by other area users may be reclaimed and revegetated by the Operators following Class III cultural resource surveys. In addition, the BLM may require the construction of adequate turnouts on new crowned-and-ditched roads to provide access from these new roads to existing two-tracks and other undeveloped roads.

4.5.1.6 Cumulative Impacts

The CIAA for land status/use is the J2PA; therefore, cumulative impacts are the same as impacts for each of the alternatives. Land ownership would not change, and natural gas recovery would become a dominant use, but not to the exclusion of other existing uses. After the LOP, land use would revert to livestock grazing, wildlife habitat, and recreation.

4.5.1.7 Unavoidable Adverse Impacts

There would be no unavoidable adverse impacts to land status/use.

4.5.2 Livestock/Grazing Management

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with livestock/grazing management:

- to improve forage production and ecological conditions for the benefit of livestock use, wildlife habitat, watershed, and riparian areas;
- to maintain, improve, or restore riparian habitat to enhance forage conditions, wildlife habitat, and stream quality; and
- to achieve proper functioning condition or better on 75% of riparian areas.

The following analyses demonstrate that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.5.2.1 The Proposed Action

The J2PA contains a total of 4,986 AUMs distributed among six grazing allotments. The principal impact to livestock/grazing management would be the direct impact resulting from the removal of forage due to the construction of well locations, roads, and pipeline ROWs. Short-term removal of vegetative cover would remove range land from production for a few years until revegetation is successful, at which time grasses--the preferred diet of cattle and wild horses--would be more abundant than prior to disturbance, thus increasing forage and AUMs. By the end of the fourth year of field development, 60 AUMs would be lost due to short-term disturbance (Table 4.8). This would amount to 0.4% of the total AUMs available in the six affected allotments. Disturbance would be greatest in the Sand Draw allotment and less in each of the remaining five allotments.

Short-term disturbance would be spread over the development period and would be scattered throughout the J2PA in small parcels, so that relatively few areas of small size would be disturbed in any one year. After a few years, much of the previously disturbed land would be revegetated and producing more grass forage than prior to disturbance, so the entire area of short-term disturbance would never all be out of production at the same time. Using a weighted average, the J2PA provides 1 AUM for every 12.0 acres. If the assumption is made that within 4 years after disturbance a disturbed area would produce twice as much livestock forage as before it was disturbed, there would never be more than 720 acres (60 AUMs) at less than full production due to short-term disturbance (see Table 4.8). Applicant-committed practices to mitigate impacts to livestock/grazing management from vegetation removal include prompt reclamation of disturbed areas not required for LOP operations. After the fourth year of operations, reductions in AUMs would decrease due to the additional forage provided by reclaimed lands. By the 16th year of operations, AUMs would increase by 15 over predisturbance conditions.

A total of 1,086 acres of new LOP vegetation removal would result in the loss of 91 AUMs annually, or 1.8% of the total AUMs in the J2PA. These losses would not all be in the first year, but would accumulate as additional development occurred over the LOP. However, this loss, associated with those portions of well pads, roads, and other disturbances that would not be reclaimed and revegetated until abandonment, would be more than compensated for by the increased forage production on reclaimed lands subjected to short-term disturbance. As with short-term disturbance, LOP disturbance would be greatest in the Sand Draw allotment.

The construction of additional roads and associated reclamation efforts could affect the pattern of livestock forage utilization on the J2PA and could concentrate animals along roads and on reclaimed areas, thus increasing the chances of vehicle/livestock collisions. However, the BLM, Operators, and livestock permittees would monitor livestock movements and appropriate measures would be taken to correct any such movements that produce undesirable results (see Section 2.4.11.10 [2]). Construction and drilling activities could contribute to livestock movement off uplands and concentration in riparian and reclamation areas, thereby impeding reclamation success; however, this probably would be minimal because construction and drilling activities are very localized. Applicant-committed practices would ensure that natural gas development activities would not interfere with lambing operations, and that vehicle/livestock collisions would be minimized (see Section 2.4.11.9 [2]). The Operators would repair fences, cattleguards, gates, etc., to maintain current BLM standards. Livestock would be protected from pipeline trenches and livestock access to water would be maintained (see Section 2.4.11.10 [1]).

Table 4.8 Short-term and LOP AUM Disturbance Associated with the Proposed Action, Jonah Field II Natural Gas Development Project, 1997.

Year	Acres Disturbed[1]	AUMs Lost[2]	Acres Reclaimed[3]	AUMs Reclaimed[4]	Net AUMs
1	180	15	0	0	-15
2	180	15	120	0	-30
3	180	15	120	0	-45
4	180	15	120	0	-60
5	180	15	120	20	-55
6	180	15	120	20	-50
7	180	15	120	20	-45
8	180	15	120	20	-40
9	180	15	120	20	-35
10	180	15	120	20	-30
11	180	15	120	20	-25
12	180	15	120	20	-20
13	180	15	120	20	-15
14	180	15	120	20	-10
15	180	15	120	20	-5
16	0	0	120	20	15
17	0	0	0	20	35
18	0	0	0	20	55
19	0	0	0	20	75
			11-year Break for Production		
30	0	0	72	0	0
31	0	0	72	0	0
32	0	0	72	0	0
33	0	0	72	12	87
34	0	0	72	12	99
35	0	0	72	12	111
36	0	0	72	12	123
37	0	0	72	12	135
38	0	0	72	12	147
39	0	0	72	12	159
40	0	0	72	12	171
41	0	0	72	12	183
42	0	0	72	12	195
43	0	0	72	12	207
44	0	0	72	12	219
45	0	0	0	12	231
46	0	0	0	12	243
47	0	0	0	12	255

1 The 5.9 acres per well times 30 wells equals 177 and is rounded to 180.
2 Predisturbed acres produce at the rate of 12 acres/AUM.
3 The acres reclaimed were rounded from 118.6 to 120 for simplicity.
4 Reclaimed acres produce at the rate of 6 acres/AUM (for cattle and wild horses).

4.5.2.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as the Proposed Action; however, there would be 6% less surface disturbance.

4.5.2.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce the same type of results as the Proposed Action; however, there would be 21-23% less surface disturbance.

4.5.2.4 No Action Alternative

Under the No Action Alternative, there would be no additional impacts to livestock/grazing management other than those already approved in the Jonah EA (BLM 1994b). In addition, the opportunity to increase forage production for livestock would be foregone. The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts to livestock grazing as a result of that project.

4.5.2.5 Mitigation

Fencing could be used to keep livestock away from all pits containing fluids. This would avoid conflicts with livestock drinking contaminated water.

4.5.2.6 Cumulative Impacts

The CIAA for livestock/grazing includes all of the six grazing allotments (Stud Horse Common, Sand Draw, Blue Rim Desert, Alkali Draw, South Desert, and Boundary), portions of which are included within the J2PA. These six allotments cover 171,409 acres (267.8 mi^2). RFD in these allotments includes 28 AUMs of long-term disturbance associated with development described in the Jonah EA (BLM 1994b), as well as approximately 6 acres of long-term disturbance associated with anticipated exploration-related activities (assuming 0.023 acres per mi^2 [see Section 4.0)]. The Jonah II Field development would result in a maximum short-term loss of 0.4% of the combined grazing allotments (i.e., 60 AUMs). However, as areas disturbed during initial project construction are reclaimed, it is anticipated that production of palatable grass forage would increase, thereby augmenting forage availability by 255 AUMs by the end of the project.

4.5.2.7 Unavoidable Adverse Impacts

The action alternatives would result in the temporary loss of livestock forage and available AUMs.

4.5.3 Recreation

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with recreation:

- to ensure the continued availability of outdoor recreational opportunities sought by the public while protecting other resources;
- to prevent resource degradation resulting from recreation and other uses and to provide for the anticipated increase in recreational uses on BLM-administered lands; and
- to conserve and develop scenic resources for the benefit of present and future generations.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.5.3.1 The Proposed Action

No developed recreation sites or facilities are present in or immediately adjacent to the J2PA; therefore, none would be affected. There could be some long-term displacement or elimination of existing dispersed recreation due to the presence of gas field development activities. Some potential users might avoid the area due to a perceived reduction in the quality of the recreational experience as a result of increases in road density, gas wells, and associated development. However, hunting pressure likely would be related in large measure to wildlife populations, and in the absence of reductions in populations of pronghorn and sage grouse--the two principal target species in the J2PA--hunting pressure likely would remain near present levels. Additionally, improved roads on the area may promote additional recreational use (e.g., driving for pleasure, road hunting).

Outdoor recreation is important both in terms of the satisfaction it provides residents of the region and for

the activity it generates in the region's economy as a result of expenditures by nonresident visitors. If the proposed project results in a decrease in hunting on the J2PA and hunters do not move to alternative locations, there would be a decrease in hunter-generated revenues.

4.5.3.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as the Proposed Action; however, sage grouse leks would receive greater protection from disturbance.

4.5.3.3 Alternative B - Maximum Location Density

Implementation of Alternative A would produce the same type of results as the Proposed Action.

4.5.3.4 No Action Alternative

Under the No Action Alternative, there would be no additional impacts to recreation other than those previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts to recreation as a result of that project.

4.5.3.5 Mitigation

No additional mitigation is identified.

4.5.3.6 Cumulative Impacts

The CIAA for recreation encompasses 1,548,800 acres (2,420 mi^2) (see Map 4.3). Existing surface disturbance includes approximately 67,520 acres (106 mi^2), or 4.4% of the CIAA, and results primarily from agriculture and hayfields (56%) and roads and pipeline ROWs (22%) (see Table 4.6). Project-related long-term disturbance would total 934 acres under the Proposed Action. Acreages associated with Alternatives A and B are slightly lower (878 and 724 acres, respectively).

RFD disturbance in the CIAA includes 1,988 acres (3.1 mi^2) associated with natural gas development described in the Fontenelle EIS (BLM 1995b) and 56 acres anticipated as a result of exploratory wells (see Section 4.0). Proposed oil and gas development would occur primarily along the Green River from Bird Canyon south through Fontenelle.

The maximum total cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) anticipated within the recreation CIAA is 70,498 acres (110 mi^2), or 4.6% of the CIAA (see Table 4.6). Agricultural lands comprise the greatest portion of this disturbance (54%), followed by roads and pipeline ROWs (24%), lakes/reservoirs and residential areas (8% each), oil/gas well (4%), and other disturbance (2%) (see Table 4.6).

Because the majority of workers employed for both the proposed project and RFD would be hired from the local workforce, there would be little increase in local populations and the demand for recreation. Some traditional dispersed recreation could be directed away from areas with increased road and well development for the long-term due to a perceived reduction in the quality of the recreational experience on the part of the user (see Section 4.6.6), and current users of recipient areas may be adversely affected by increased use, over-crowding, and/or a feeling that the quality of the recreation experience of solitude has been decreased. On the other hand, additional road development could encourage use of previously unroaded areas.

4.5.3.7 Unavoidable Adverse Impacts

Some reduction in recreational use could occur due to a perception by potential users of a reduction in the quality of the recreational experience resulting from natural gas development.

4.6 VISUAL RESOURCES

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with visual resources:

- to maintain or improve scenic values and visual quality and to establish priorities for managing the visual resources in conjunction with other resource values; and
- to conserve and develop scenic resources for the benefit of present and future generations.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.6.1 The Proposed Action

Implementation of the Proposed Action would result in a long-term change in the visual characteristics of the J2PA from a relatively undisturbed area to a developed natural gas field. However, the entire J2PA is classified as VRM Class IV, and the development anticipated for the Proposed Action would be compatible with that classification given that the Operators would utilize existing topography to screen roads, pipelines, well pads, and would paint aboveground production facilities to blend with adjacent terrain (see Section 2.4.11.15). Improvements to the Luman Road at its junction with U.S. Highway 191 would occur within a VRM Class III area; however, impacts to visual resources associated with road improvements are not anticipated to be noticeable to the casual observer.

4.6.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would produce the same type of results as the Proposed Action; however, there would be 30 fewer well locations, resulting in less visual impact.

4.6.3 Alternative B - Maximum Location Density

Implementation of Alternative B would produce the same type of results as the Proposed Action; however, there would be 123 fewer well locations, resulting in less visual impact.

4.6.4 No Action Alternative

Under the No Action Alternative, there would be no additional impacts to visual resources other than those previously approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts to visual resources as a result of that project.

4.6.5 Mitigation

No additional mitigation is identified.

4.6.6 Cumulative Impacts

The CIAA for visual resources encompasses 1,548,800 acres (2,420 mi^2) (see Map 4.1). Existing surface disturbance includes approximately 67,520 acres (106 mi^2), or 4.4% of the CIAA, and results primarily from agriculture and hayfields (56%) and roads and pipeline ROWs (22%) (see Table 4.6). Project-related new long-term disturbance on the J2PA would total 934 acres under the Proposed Action, all of which would occur on areas designated as VRM Class IV. Acreages associated with Alternatives A and B are slightly lower (878 and 724 acres, respectively).

RFD disturbance in the CIAA includes 1,988 acres (3.1 mi^2) associated with natural gas development described in the Fontenelle EIS (BLM 1995b). Under the BLM's preferred alternative for the Fontenelle Project (BLM 1996d), 36 wells and associated roads and pipelines would be constructed in Class II areas and 37 well and associated roads and pipelines would be constructed in Class III areas. Additionally, 56 acres of long-term disturbance are anticipated throughout the CIAA as a result of oil and gas exploration (see Section 4.0).

The maximum total cumulative disturbance (i.e., the combined existing, proposed, and RFD disturbance) anticipated within the recreation CIAA is 70,498 acres (110 mi^2), or 4.6% of the CIAA (see Table 4.6). Agricultural lands comprise the greatest portion of this disturbance (54%), followed by roads and pipeline ROWs (24%), lakes/reservoirs and residential areas (8% each), oil/gas well (4%), and other disturbance (2%) (see Table 4.6).

Most of the 2,420-mi^2 CIAA for visual resources (see Map 4.1) is BLM VRM Class IV. Class IV areas allow management activities that require major modifications of the existing character of the landscape. Although the activities may dominate the view of the casual observer and the relative change to the landscape may be high, all management activities must be conducted to minimize the impact to the visual quality of the area. The J2PA is entirely within areas managed by the BLM as Class IV; therefore, project-related disturbance is within the management objectives prescribed by the BLM for the project area.

The northeastern portion of the CIAA (the Scab Creek area) is categorized as a Class I area, and Class II and III areas also exist throughout the CIAA, primarily as corridors along rivers, major highways, and the Wind River front. No Class I or II VRM areas would be affected by the Jonah II Field project and only the Luman Road junction with U.S. Highway 191 and possibly future field access routes

are anticipated to occur within VRM Class III areas; therefore, these areas would not experience any notable change in cumulative impacts as a result of this project. The presence of Class I and II areas within the CIAA would continue to provide the opportunity for recreational and other use within these more pristine, less visually impacted areas.

4.6.7 Unavoidable Adverse Impacts

The addition of gas development and production facilities and associated roads is an unavoidable adverse impact to visual resources. This impact would occur throughout the LOP and for some time into the future, since reclaimed lands may take many years (20+) to assume predisturbance visual characteristics.

4.7 HAZARDOUS MATERIALS

The PRA and GRRA RMPs (BLM 1987b, 1996a) and state (WSLUC 1979) and local (SCBC 1978) land use plans prescribe the following management objectives associated with hazardous materials:

- to protect public and environmental health and safety on BLM-administered public lands;
- to comply with applicable federal and state laws;
- to prevent waste contamination due to any BLM-authorized actions;
- to minimize federal exposure to the liabilities associated with waste management on public lands; and
- to integrate hazardous materials and waste management policies and controls into all BLM programs.

The following analyses show that the Proposed Action and alternatives are compatible with these management objectives, and no significant impacts are anticipated.

4.7.1 The Proposed Action

Impacts to soils, surface and groundwater resources, and wildlife could result from accidental hazardous materials spills, pipeline ruptures, and/or exposure to these materials. It is likely that only small amounts of soil potentially would be contaminated and, should this occur, the affected area would be cleaned up in an appropriate and timely manner. Proper containment of oil and fuel in storage areas, containment of fluids in reserve pits, appropriate pipeline design and construction, proper well casing and cementing, and location of wells away from drainages would prevent potential surface and groundwater contamination (see Section 2.4.11.17 and Appendix C). Project operations would comply with all relevant federal and state laws regarding hazardous materials and with directives identified in the Hazardous Materials Summary for this project (see Appendix C) and existing SPCCPs. Birds and mammals would be excluded from reserve pits that contain potentially harmful substances by installation of fences and/or netting (see Section 2.4.11.9 [6]).

4.7.2 Alternative A - Sensitive Resource Protection

Implementation of Alternative A would have the same impacts as those of as the Proposed Action; however, there would be 30 fewer well locations, resulting in fewer opportunities for material spills, pipeline ruptures, and/or exposure to hazardous materials.

4.7.3 Alternative B - Maximum Location Density

Implementation of Alternative B would have the same impacts as those of the Proposed Action; however, there would be 123 fewer well locations, resulting in fewer opportunities for material spills, pipeline ruptures, and/or exposure to hazardous materials.

4.7.4 No Action Alternative

Under the No Action Alternative, there would be no additional opportunities for material spills, pipeline ruptures, and/or exposure to hazardous materials above present levels other than those posed by activities already approved in the Jonah EA (BLM 1994b). The DR and FONSI for the Jonah EA concluded there would be no significant adverse impacts involving hazardous materials as a result of that project.

4.7.5 Mitigation

The BLM may require Operators to fill pipelines with a clay or cement slurry prior to abandonment.

4.7.6 Cumulative Impacts

The CIAA for hazardous materials is the J2PA and a 2-mi buffer. Little additional disturbance is anticipated in the 2-mi buffer around the J2PA other than some road upgrades that would disturb relatively

small areas adjacent to existing disturbance (see Appendix A), and impacts described in the Jonah EA (BLM 1994b). These would have impacts similar in kind to those already described in Section 4.7.1.

4.7.7 Unavoidable Adverse Impacts

Some small spills of, or exposure to, hazardous materials could occur; however, with implementation of appropriate precautions as outlined in Chapter 2.0 and Appendix C, such occurrences would be minimized.

4.8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible and irretrievable commitment of resources is defined as a permanent reduction or loss of a resource that, once lost, cannot be regained. The primary irreversible and irretrievable commitment of resources from the proposed project would result from removal and use of the gas and oil reserves. Other irreversible and irretrievable commitments of resources would include soil lost through wind and water erosion; loss of productivity (i.e., forage, wildlife habitat) from lands devoted to project activities (i.e., well location, roads) during the time those lands are out of production and until they are revegetated; inadvertent or accidental destruction of paleontological or cultural resources during construction and increases in illegal collecting; loss of animals due to mortality during earthmoving activities or through collisions with vehicles; and labor, materials, and energy expended during construction, drilling, production, and reclamation associated with the project.

4.9 SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

For purposes of this discussion, short-term use of the environment is that use during the LOP, whereas long-term productivity refers to the period after the project is completed and the area is reclaimed and revegetated.

The short-term use of the environment would not affect the long-term productivity of the J2PA or adjacent areas. After the project is completed and disturbed areas reclaimed, the same resources that were present prior to the project would be available, except for the oil and gas resources. It may take 20 years of more after the LOP for some of the reclaimed areas to revegetate with shrub productivity comparable to predisturbance levels; however, reclamation would provide conditions to support wildlife, livestock, and recreation. Use of the project area during the LOP would not preclude the subsequent long-term use of the area for any purpose for which it was suited prior to the project.

5.0 CONSULTATION AND PREPARERS

Personnel contacted or consulted during preparation of this EIS are listed in Table 5.1. The list of preparers and participants is given in Table 5.2.

Table 5.1 Personnel Contacted or Consulted, Jonah Field II Natural Gas Project, Sublette County, Wyoming, 1997.

Agency or Organization	Individual	Position
Amoco Production Company	D.N. Blewitt	Certified Consulting Meteorologist
	Harmon Heidt	Petroleum Engineer
	Kirk Steinle	Environmental Affairs Specialist
Anderson Environmental Consulting	Bob Anderson	Environmental Consultant
B&B Oilfield Services/B&B Tire and Auto	John Bookless	Owner
Big Sandy Conservation District	--	--
Bjork, Lindley & Danielson, P.C.	Laura Lindley	Attorney at Law
Bureau of Land Management		
Casper District Office	Laurie Bryant	Paleontologist
	Fred Crockett	Reservoir Management
Denver Regional Office	Scott Archer	Air Quality Specialist
Kemmerer Resource Area	--	--
Pinedale Resource Area	Tom Curry	Natural Resource Specialist
	Dave Harper	Realty Specialist
	Grace Jensen	Realty Specialist
	Steve Laster	Rangeland Management Specialist
	Bob McCarty	Wildlife Biologist
	Greg Noble	Petroleum Engineer
	Doug Powell	Rangeland Management Specialist
	Leslie Theiss	Area Manager
	Dave Vesterby	Recreation Specialist
	Dave Vlcek	Archaelogist
Rawlins District Office	Larry Jackson	Environmental Compliance
	Kurt Kotter	District Manager
	John Spehar	Environmental Specialist

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Rock Springs District Office/ Green River Resource Area	Rick Canterbury	Environmental Specialist
	Teresa Deakins	Environmental Compliance
	Dennis Doncaster	Hydrologist
	Jim Dunder	Wildlife Biologist
	Tom Groves	Rangeland Management Specialist
	John Henderson	Fisheries Biologist
	Arlan Hiner	District Office Team Leader
	John MacDonald	District Soil Scientist
	Bill McMahan	Environmental Compliance
	Angelina Pryich	Editor
	Thor Stephenson	Wild Horse Specialist
Wyoming State Office	Jeff Carroll	Sensitive Species Specialist
	Vickie Daniels	Minerals Specialist
	Tom Enright	Environmental Coordinator
	Jon Johnson	State Office Lead
	Tom Lahti	Natural Resource Specialist
	Patrick Madigan	Map Specialist
	Jack Pederson	Economic Evaluation
	Rick Schuler	Soil Scientist
Chevron	Steve Ziman	--
City of Big Piney	--	Mayor
City of Farson	--	Postmaster
City of Green River	--	Chamber of Commerce
	--	Mayor
City of LaBarge	--	Mayor
City of Marbleton	--	Mayor
City of Pinedale	Rose Skinner	Mayor
City of Rock Springs	--	Chamber of Commerce
	--	Library
	--	Mayor
David W. Neher Consulting Service	David W. Neher	Consultant
Eastern Shoshone Tribe	Michael Chiropolos	Tribal Attorney's Office
	Edith Griswald	--
	John Tarnesse, Sr.	--
	Alfred Ward	Tribal Chairman
	Haman Wise, Sr.	--
Erathem-Vanir Geological	Gus Winterfeld	Paleontologist
Frank's Construction Company	Frank S. Virden	Owner
Grazing Permittees, Affected Allotments	--	--
Green River Basin Advisory Committee Members	--	--

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Green River Cattlemen's Association	--	--
Green River/Rock Springs Joint Powers Water Board	Deanna Holloway	Administrative Assistant
Halliburton Company	Dick Cheney	Chairman of the Board, President, and Chief Executive Officer
Independent Petroleum Association of Mountain States	Barbara Widick	Director of Regulatory Affairs
Individuals	Eli Bebout	Citizen
	Chris Bookless	Citizen
	James Goddard	Citizen
	Jay McGinnis	Grazing Permittee
	Scott McKern	Consulting Archaeologist
	Peter S. Olsen	Local Rancher
	Robert E. Olsen	Citizen
	Chip Rawlins	Citizen
	Linda Rawlins	Citizen
	Jack Simms	Grazing Permittee
	Donna Steele	Owner, Boulder Store
	Bill Taliaferro	Citizen
	Cat Urbigkit	Citizen
	Frank Virden	Citizen
	Nancy Virden	Citizen
	Chuck Walter	Citizen
	Martin Wardell	Citizen
	Brian Young	Citizen
	Jeff Young	Citizen
Intermountain Ecosystems	Ron Kass	Botanist
Lincoln County		
County Commissioner	--	Lincoln County Commissioner
County Library	--	Librarian
County Planner	--	Lincoln County Planner
Linnco Corporation	--	President
Marathon Oil Company	Mike Mueller	--
McMurry Oil	John Martin	President
	Mick McMurry	Vice President
	Casey Osborn	--
Minerals Management Service	--	--
National Park Service	--	Rocky Mountain Regional Director
National Wildlife Federation	--	--

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Newspapers		
Bridger Valley Pioneer-Lyman	--	Editor
Casper Star-Tribune	--	Editor
Green River Star	--	Editor
Jackson Hole Daily	--	Editor
Jackson Hole News	--	Editor
Jackson Hole Guide	--	Editor
Kemmerer Gazette	--	Editor
Pinedale Roundup	--	Editor
Rawlins Daily Times	--	Editor
Riverton Ranger	--	Editor
Rock Springs Daily Rocket-Miner	--	Editor
Star Valley Independent-Afton	--	Editor
Sublette County Journal-Big Piney	--	Editor
Uinta County Herald-Evanston	--	Editor
Wyoming State Journal-Lander	--	Editor
Northern Arapahoe Tribe	Francis Brown	--
	Burton Hutchinson	--
Oregon-California Trails Association	Robert E Rennels	--
People for the West	Robin Sherwood	--
Petroleum Association of Wyoming	Kathy Springer	--
Radio Stations	--	--
KEVA/KOTB - Evanston		
KMER - Kemmerer		
KOVE/KLDY - Lander		
KQSW/KRKK - Rock Springs		
KRSV - Afton		
KSGT/KMTN - Jackson		
KSIT - Rock Springs		
KTWO/KMGW - Casper		
KUGR/KVCS - Green River		
KUWR - Laramie		
KVOC - Casper		
KYCS - Rock Springs		
Rendezvous Ranch	Paul VonGontard	--
Rice Enterprises	James D. Rice	Owner
Rock Springs Grazing Association	--	--
Rocky Mountain Oil and Gas Association	--	--
Rural Wyoming League	Rob Shaul	Executive Director
Samuelson and Associates	Doug Samuelson	Owner
	Susan Samuelson	Owner
Sandy Crossing Enterprises Incorporated	Curtis C. Martin	President

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Seedskadee Wildlife Refuge	--	--
Sherwood Enterprises Incorporated	Robin A. Sherwood	--
Shoshone/Arapahoe Tribes	Don Aragon Shoshone-Arapahoe Joint Tribal Council	Environmental Specialist --
Sierra Club	--	Northern Plains Representative
Snyder Oil Corporation	Deven K. Delap Jeff Johnson Tim Morris Dick Pate David Petersen	District Superintendent -- Senior Landman -- --
Southwest Wyoming Industrial Association	--	--
Southwest Wyoming Mineral Association	--	--
State of Wyoming	Bud Betts Chris Boswell Boyd Eddins John Eyre Mark Harris Grant Larson Clarene Law Randall Luthi Pete Maxfield Wayne Morrow Bud Nelson Fred Parady Gordon Park Frank Prevedel Gregory Phillips Louise Ryckman Ray Sarcletti Louie Tomassi Kenilynn Zanetti	State Representative State Representative State Senator State Representative State Senator State Senator State Representative State Representative State Senator State Representative State Representative State Representative State Representative State Senator State Senator State Representative State Senator State Representative State Representative
State of Wyoming Administration and Information, Division of Economic Analysis	Wenlin Liu	Economic Analyst
State of Wyoming Public Service Commission	Jon Jaquot	Engineering Supervisor

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Sublette County	Misty Haehn	County Planner
	Stuart McKinley	County Commissioner
	--	County Library, Big Piney
	--	County Library, Pinedale
	Bert Reino	County Health Department
	Mike McGinnis	Road and Bridge
	B. Weldon Shelley	Superintendent of School, School District No. 9
Sweetwater County	--	County Commissioner
	--	County Librarian
	Mark Kot	Sweetwater County Planner
	John Nelson	County Engineer
Television Stations		
KCWY-TV - Casper		
KFNB-TV - Casper		
KGWC-TV - Casper		
KTWO-TV - Casper		
Sweetwater Television		
Ultra Petroleum	Bryan Hughes	--
Union Pacific Resources Company	Dave Petrie	--
University of California, Berkeley, Museum of Paleontology	Pat Holroyd	Paleontologist
Upper Green River Cattle Association	Charles Price	--
U.S. Bureau of Indian Affairs	--	Superintendent
U.S. Bureau of Reclamation, Upper Colorado Region	--	--
U.S. Congress	Cathy Berg	Representative for Congresswoman Barbara Cubin
	Barbara Cubin	U.S. Congresswoman
	Katie Legerski	Representative for Congresswoman Barbara Cubin
	Lyn Shanaghy	Representative for Senator Alan Simpson
	Alan Simpson	U.S. Senator
	Pati Smith	Representative for Senator Craig Thomas
	Craig Thomas	U.S. Senator
U.S. Department of the Army, Corps of Engineers, Omaha District	Chandler Peter	Project Manager, Wyoming Regulatory Office
U.S. Environmental Protection Agency, Region VIII	Robert Edgar	--
	Shawn McCaffrey	--
	Mike Strieby	Environmental Scientist, Environmental Review Coordinator
U.S. Fish and Wildlife Service	Charles P. Davis	State Director, Cheyenne
	Mary Jennings	Wildlife Biologist

Table 5.1 (Continued)

Agency or Organization	Individual	Position
U.S. Forest Service	Tamara Blett	--
	Ann Mebane	Air Quality Specialist
	Robert Reese	District Ranger, Bridger-Teton National Forest
	Al Riebau	--
	Richard Sanders	Watershed and Air Management, Director
U.S. Natural Resource Conservation Service, Farson Office	--	--
Ute Mountain Tribe	--	Chairman
Ute Tribe	Luke Duncan	Chairman, Ute Tribal Council
	--	Chairman, Uinta-Ouray Tribal Council
Western Gas Resources	Don Freeman	--
	Dave Hatfield	--
	Jeffery Jones	--
	Mike Todd	--
	Christopher Wilson	Sr. Business Development Representative, Southwest Wyoming Area
Western Shoshone Tribe	Diana Yupe	Cultural Resource Coordinator/Anthropologist
Western Wyoming College	Kevin Thompson	Archaeologist
Wexpro Company	Terry Nimko	--
White Mountain Library	--	--
Wilderness Society	--	--
Wildlife Consulting	James Straley	Wildlife Consultant
Wyoming Association of Professional Archaeologists	--	--
Wyoming Department of Commerce	Rick Honicutt	--
Wyoming Department of Education	Judy Catchpole	Superintendent of Public Instruction
Wyoming Department of Employment Research and Planning	Gordon Wolford	Senior Statistician
Wyoming Department of Environmental Quality - Air Quality Division	Chuck Collins	--
	Bernie Dailey	--
	Lee Gribovicz	--
Wyoming Department of Transportation	Bob Maxim	--
	Jim Monturo	--
Wyoming Division of Cultural Resources	John Keck	State Historic Preservation Officer
Wyoming Division of Economic Analysis	Wenlin Liu	--

Table 5.1 (Continued)

Agency or Organization	Individual	Position
Wyoming Game and Fish Department	Dennis Almquist	Game Warden
	Joe Bohne	Management Coordinator
	Tom Christianson	Wildlife Biologist
	Doug McWhirter	Wildlife Biologist
	Bill Wichers	Deputy Director
Wyoming Geological Survey	Jim Case	Geologic Hazards Specialist
Wyoming Mining Association	--	--
Wyoming Natural Diversity Database	Walter Fertig	Botanist
	Laura Giankos	--
	George Jones	T&E Specialist
	Mary Neighbors	Information Manager
Wyoming Office of the Governor	Jim Geringer	Governor, State of Wyoming
	Paul Kruse	Asst. Director, Office of Federal Land Policy
	James Magana	Director, Office of Federal Land Policy
Wyoming Oil and Gas Conservation Commission	Donald Basko	State Oil and Gas Supervisor
	Janie Nelson	--
	Cheryl Ondler	--
Wyoming Outdoor Council	Dan Heilig	Associate Director
	Tom Stroop	--
Wyoming Public Lands Council	--	--
Wyoming Resource Advisory Council Members	Bob Bud	--
Wyoming Road and Bridge Department	Mike McGinnis	Foreman
Wyoming State Clearinghouse	--	--
Wyoming State Historic Preservation Office	John Keck	--
Wyoming State Land and Farm Loan Office	D.S. Degenfelder	Deputy Director
Wyoming State Treasurer's Office	Ken Rolfness	--
Wyoming Wildlife Federation	Dan Chu	--
	Tom Segerstrom	--

Table 5.2 List of Preparers and Participants, Jonah Field II Natural Gas Project, Sublette County, Wyoming, 1997.

Name	EIS Responsibility
BLM INTERDISCIPLINARY TEAM	
<u>Casper District Office</u>	
Laurie Bryant	Paleontological Resources
Fred Crockett	Reservoir Management
<u>Denver Regional Office</u>	
Scott Archer	Air Quality
<u>Pinedale Resource Area</u>	
Tom Curry	Reclamation, Environmental Issues
Dave Harper	Lands
Steve Laster	Range, Vegetation, Special Status Plants
Bob McCarty	Wildlife
Greg Noble	Resource Area Team Leader, Petroleum Engineer
Dave Vesterby	Recreation
Dave Vlcek	Cultural Resources
<u>Rock Springs District Office/Green River Resource Area</u>	
Teresa Deakins	Sociology, NEPA Process
Dennis Doncaster	Watershed, Hydrology
Jim Dunder	Wildlife Resources
Tom Groves	Range Resources
John Henderson	Riparian Areas/Wetlands
Arlan Hiner	District Office Team Leader
John MacDonald	Soils, Hazardous Materials
Thor Stephenson	Wild Horses
<u>Wyoming State Office</u>	
Jon Johnson	State Office Lead, NEPA Compliance
Jack Pederson	Economic Resources

Table 5.2 (Continued)

Name	EIS Responsibility
INTERAGENCY TEAM	
City of Pinedale	
Rose Skinner	Mayor
Sublette County	
Stuart McKinley	County Commissioner
U.S. Environmental Protection Agency	
Mike Strieby	Environmental Scientist/Coordinator
U.S. Fish and Wildlife Service	
Mary Jennings	Wildlife Resources
U.S. Forest Service	
Anne Mebane	Air Quality
Wyoming Department of Environmental Quality - Air Quality Division	
Lee Gribovicz	Air Quality
Wyoming Game and Fish Department	
Dennis Almquist	Wildlife Resources
Doug McWhirter	Wildlife Resources
SUBCONTRACTORS	
Anderson Environmental Consulting Bob Anderson	Project Description, Wildlife
Erathem-Vanir Geological Gus Winterfeld	Paleontological Resources
TRC ENVIRONMENTAL CORPORATION	
Cliff Cole	Air Quality
Jim Zapert	Air Quality
TRC MARIAH ASSOCIATES INC.	
Karyn C. Classi	Physical Resources
Genial G. DeCastro	Quality Assurance, Document Production
Peter J. Guernsey	Project Management, Vegetation/Range Resources, Reclamation Wildlife/T&E
Bill Harding	Cultural Resources
Craig L. Kling	Quality Assurance
Tamara Linse	Document Production/Coordination

Table 5.2 (Continued)

Name	EIS Responsibility
James A. Lowe	Historic Resources
Suzanne Luhr	Cartography
F. Russell Pickering	Noise, Odor, Hazardous Materials, Transportation
Roger A. Schoumacher	Biological Resources, Socioeconomics, Visual Resources, Land Use
Craig S. Smith	Cultural Resources
Diane M. Thomas	Wildlife/T&E, Quality Assurance/Quality Control
Scott Walker	GIS Management

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6.2 ABBREVIATIONS AND ACRONYMS

°F	Degrees Fahrenheit
μg	Micrograms
$\mu g/m^3$	Micrograms per cubic meter
AASHTO	American Association of State Highway and Transportation Officials
acre-ft	Acre-foot/feet
Amoco	Amoco Production Company
ANC	Acid neutralization capacity
ANS	Artificial nest structure
AO	Authorizing Officer
APD	Application for Permit to Drill
AQD	Air Quality Division, WDEQ
AQRV	Air quality related values
ARPA	Archaeological Resources Protection Act of 1979
AUM	Animal Unit Month
BA	Biological assessment
BACT	Best Available Control Technologies
bbl	Barrels
bcpd	Barrels of Condensate per Day
BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (as amended)
CFR	Code of Federal Regulations. Numbers refer to title and part; that is, 40 CFR 1500 refers to title 40, part 1500
CIAA	Cumulative Impact Assessment Area
CO	Carbon monoxide
COE	U.S. Army Corps of Engineers
CSU	Conditional Surface Use
CWA	Clean Water Act
dBA	A-weighted Decibel
DEIS	Draft environmental impact statement
DR	Decision Record
EA	Environmental assessment
EIS	Environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FLPMA	Federal Land Policy and Management Act of 1976
ft	Foot or feet
gal	Gallon(s)
GIS	Geographic Information System
gpm	Gallons per minute
GRBAC	Green River Basin Advisory Committee
GRRA	Green River Resource Area
HAP	Hazardous air pollutants
ha-yr	Hectare-years
hp	Horsepower
hp-hr	Horsepower-hour
HS-20	Refers to the AASHTO truck type and axle load rating
I-80	Interstate 80
IWAQM	Interagency Workgroup on Air Quality Modeling
J2PA	Jonah Field II Project Area
Jonah EA/DR	Jonah Prospect Field Natural Gas Development EA/DR
kg	Kilogram(s)
l	liter
lb(s)	Pound(s)
LOP	Life-of-project (30 to 50 years)
LQD	Land Quality Division, WDEQ
m	Meter
mcf	Thousand cubic feet
MEI	Maximally exposed individual
mg	Milligram
mg/l	Milligram(s) per liter
mi	Mile(s)
MLE	Most likely exposure
mmcf	Million cubic feet
mmcfd	Million cubic feet per day
MOC	McMurry Oil Company
mph	Miles per hour
NAAQS	National Ambient Air Quality Standards
n.d.	No date
NEPA	National Environmental Policy Act of 1969 (as amended)
NGL	Natural gas liquids
NHPA	National Historic Preservation Act of 1966
NO_x	Nitrogen oxides
NO_2	Nitrogen dioxide
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSO	No Surface Occupancy
NTL	Notice to Lessees
Operators	McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, Western Gas Resources, and other companies
ORV	Off-road vehicle
OSHA	Occupational Safety and Health Administration
PIC	Planning Information Corportation
PM_{10}	Particulates ≤ 10 microns

POD	Plan of Development
ppm	Parts per million
PRA	Pinedale Resource Area
PSD	Prevention of Significant Deterioration
psi	Pounds per square inch
RCRA	Resource Conservation and Recovery Act of 1976 (as amended)
RFD	Reasonably foreseeable development
RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-Way
RV	Recreational vehicle
SARA	Superfund Amendments and Reauthorization Act of 1986
SCBC	Sublette County Board of Commissioners
SCJ	Sublette County Journal
SCORP	State Comprehensive Outdoor Recreation Plan
SHPO	Wyoming State Historic Preservation Office
SO_2	Sulphur dioxide
SOCO	Snyder Oil Corporation
SPCCP	Spill Prevention Control and Countermeasure Plan
SSPS	Special status plant species
SWPPP	Stormwater Pollution Prevention Plan
T&E	Threatened and Endangered
TCP	Traditional cultural properties
TDS	Total Dissolved Solids
TE&C	Threatened, endangered, and candidate species
TEC&WSC	Threatened, endandered, candidate and Wyoming species of concern
TMDL	Total maximum daily load
TPA	Transportation planning area
tpy	Tons per year
TRC Mariah	TRC Mariah Associates Inc.
TSP	Total suspended particulates
UGRCA	Upper Green River Cattle Association
UPRC	Union Pacific Railroad Company
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWCESAE	University of Wyoming, Cooperative Extension Service, Agricultural Economics
VOC	Volatile organic compounds
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WDEQ	Wyoming Department of Environmental Quality
WDOC	Wyoming Department of Commerce
WDOE	Wyoming Department of Employment
WDOR	Wyoming Department of Revenue
WDOT	Wyoming Department of Transportation
WGFD	Wyoming Game and Fish Department
WGR	Western Gas Resources
WHHMA	Wild Horse Herd Management Area
WNDDB	Wyoming Natural Diversity Database (The Nature Conservancy)
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Water Quality Division, WDEQ
WRIRRA	Wind River Indian Reservation Roadless Area
W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WWC	Western Wyoming College
YBP	Years before present

APPENDIX A:

TRANSPORTATION PLAN

TRANSPORTATION PLAN FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT

Prepared for

Pinedale Resource Area
and
Green River Resource Area
Rock Springs District
Bureau of Land Management
Rock Springs, Wyoming

By

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 11434

May 1997

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A-1.0 INTRODUCTION

A-1.1 OBJECTIVES

This transportation plan was prepared to supplement a proposal by oil and gas companies (Operators) to drill new wells in the Jonah Field II Project Area (J2PA), as described in the Jonah Field II Natural Gas Project Environmental Impact Statement (EIS). The document provides an assessment of future road development and use in and around the J2PA and potential impacts to the existing transportation system, and provides a basis for future oil- and gas-related exploration and production transportation planning within the area.

The transportation planning area (TPA) includes the J2PA plus adjacent areas that include roads which may be used to access the J2PA (Map A-1.1). The TPA includes U.S. Highway 191, 1.5 to 17.0 mi east of the J2PA, and State Highway 351, 6 mi north of the area. (More detailed maps of the TPA are available for review at the Pinedale Resource Area [PRA] and Rock Springs District, Bureau of Land Management [BLM] Offices.)

This document is an initial transportation plan, dealing primarily with corridors for proposed local and collector roads on and adjacent to the J2PA. The EIS discusses the projected well development within the area and associated impacts due to the development. Localized planning for each new well location would be necessary, and this document and applicable transportation codes and standards would be used in the localized planning efforts. Annual operational updates would be made during project development to detail specific localized transportation networks. All new or upgraded roads in the TPA would incorporate the general provisions of this planning document.

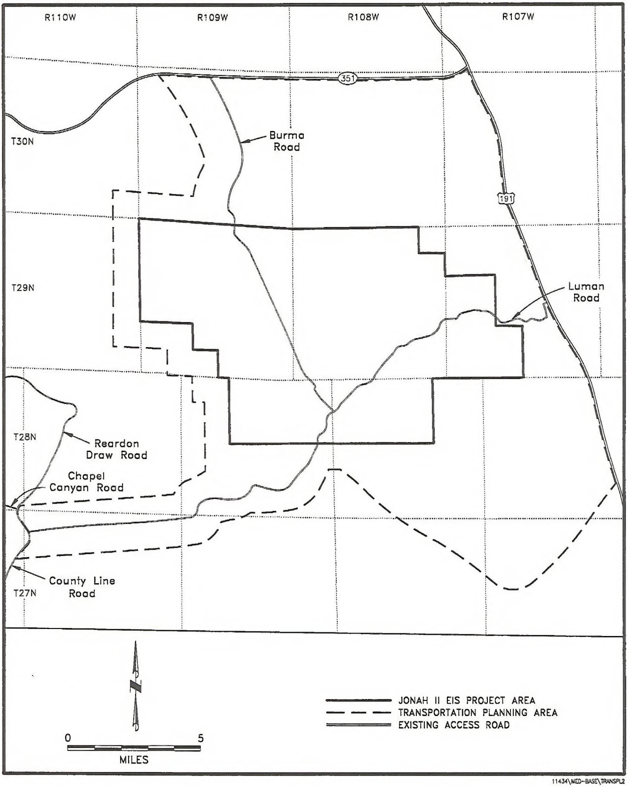
The objectives and content of this transportation planning document are listed and discussed below.

- The annual operational update process is described, including scheduling, responsibilities, and opportunities for public input.
- Existing roads in the J2PA are described, and primary routes (i.e., potential project-required collector and local roads) are identified on maps. High volume roads (i.e., local or collector roads) and resource, two track, and other unimproved roads are also discussed.
- Existing roads and road corridors that may be used as collector or local roads for the proposed project are identified.
- Existing natural gas pipelines in the J2PA are shown and pipeline development actions are presented.
- Natural transportation obstacles (e.g., steep terrain, drainages) and environmentally sensitive areas (e.g., sage grouse leks, raptor nests) are identified. These areas would be avoided, where practical, when determining the location of future high traffic volume transportation routes.
- Soils in the J2PA are identified, where known, and their limitations for project operations are presented. A brief description of field evaluation/observation methods for determining if a soil may have erosion, stability, or other problems is also presented.
- Road types are discussed by functional classification. Standard road surface, construction-related disturbance, and right-of-way (ROW) widths are provided in the EIS (see Figure 2.4).
- Maintenance and other agreements are discussed.

This document was prepared for the BLM by TRC Mariah Associates Inc. (TRC Mariah).

A-1.2 SCOPE

The scope of this plan includes a description of the existing road network, the general locations of proposed high traffic volume roads and corridors, and definitions of the road types. Relevant requirements for road construction or reconstruction are identified. A working plan is outlined to help determine the procedures for planning a road to serve a proposed well or group of wells, and the development of agreements for use and maintenance are outlined.



Map A-1.1 Transportation Planning Area.

This plan also applies to the transportation of gas, condensate, or water via pipelines within the area. Pipelines generally would be located adjacent to roads to reduce the total amount of new surface disturbance. However, this design may complicate road route selection, and in some instances, lead to increased environmental impacts. If this occurs, pipelines would be located along alternative routes. Further detail on pipelines is provided in Section 2.4.6 of the EIS.

Existing and improved access roads to the J2PA are under the jurisdiction of the BLM, who approves their design and requires their maintenance. Most roads within the J2PA also are under the jurisdiction of the BLM, and maintenance of these roads presently is conducted by Operators. This document describes the responsibility for road maintenance, and the type of maintenance is discussed generically (see Section A-9). Operators would provide the BLM with copies of road maintenance agreements that include the name of a designated contact person. Non-oil and gas roads would be maintained by the BLM or other ROW holder.

A-1.3 LIMITATIONS

- The condition (e.g., road design, upgrading requirements) and maintenance status (e.g., plowed) of existing roads and casual routes in the transportation network are identified on detailed maps available at area BLM offices. Many existing roads may not be passable during inclement weather or during winter months. All roads developed and required for this project would need upgrading, maintenance, and winter snow removal. Specific road upgrading and maintenance responsibilities would be identified in annual operational updates.
- Due to the sensitivity of paleontologic and historic/cultural resources, the known locations of these resources on and adjacent to the J2PA are not provided. Further detail on paleontological and historic/cultural resources would be collected prior to road development as a component of the Application for Permit to Drill (APD) and/or ROW application process.
- The transportation network described in this document is focused on local and collector roads and potential road corridors; however, existing low traffic volume resource roads and unimproved roads also are identified on the detailed maps available for review at area BLM offices.

A-2.0 PUBLIC INVOLVEMENT/TRANSPORTATION PLAN SCOPING

As a result of concerns identified during the preparation of past oil and gas development EISs in the region and associated Green River Basin Advisory Committee meetings, the BLM PRA requested public input on the transportation needs and concerns regarding access to the J2PA and surrounding areas. Input was requested in early January 1997, scoping letters and press releases were issued, and phone calls to potentially affected area users and management agencies were made. Those contacted include oil and gas operators; local and regional media sources; chambers of commerce; federal and state representatives; state and county transportation departments; the Wyoming Game and Fish Department and other state offices; regional libraries; recreation/conservation groups; and others commenting during scoping for the EIS. A complete list of contacts can be obtained from the BLM PRA office in Pinedale.

All comments received during the scoping process were considered in developing this transportation plan. Comments included the following.

- Roads should not be overdesigned.
- Pipelines should parallel roads.
- Pipelines and power lines should be buried.
- Unburied pipelines can spook horses and make off-road travel more difficult.
- Undesirable conditions along two-track roads (e.g., poor drainage crossings) should be repaired, and these roads should be eliminated if another road accesses the same area.
- Two-track roads that are not used and which can be reclaimed should be identified.
- Two-track roads should not be eliminated.
- Access to two-track roads from high traffic volume crowned-and-ditched roads should be maintained.
- High traffic volume crowned-and-ditched roads should be constructed such that vehicles with horse trailers can pull off the road at regular intervals and avoid parking in borrow ditches.
- Livestock and wildlife watering areas should be avoided.
- Sand Draw should be avoided.
- Sage grouse leks and associated buffers should be avoided.
- Noise impacts to sage grouse should be considered.
- Mule deer winter range west of the J2PA and east of the Green River may be impacted if access to the J2PA is through Reardon or Chapel Canyons.
- The TPA boundary should be extended westward to the Green River and southward to the Sweetwater County line.
- Sage grouse and mountain plover surveys should be conducted to better define desirable road corridors.
- Cattle guards should be cleaned out annually prior to May 1.
- The use of north/south-oriented roads should be maximized to accommodate pronghorn antelope movements.
- The use of looped roads should be minimized to avoid increased traffic.
- Turnout lanes and adequate site distances should be considered for existing and future high traffic volume access points.
- All roads developed for this project should be reclaimed when they are no longer required.
- Sublette County has no interest in acquiring any of the roads developed for this project.
- The ultimate road situation (i.e., after the project is completed) should be similar to predevelopment (pre-1990).
- The majority of large trucks currently access the J2PA using the Luman Road and the Luman Road should remain as the principal access road for large vehicles.
- The Burma Road currently is seldom used by large vehicles and should remain as such.
- Close the Burma Road or leave it unimproved if additional access to the J2PA is provided from the northeast.
- Southwest access to the J2PA is used primarily by light duty trucks.
- A road and pipeline corridor southwest of the J2PA would be required for the LOP, and an additional road and pipeline corridor may be required north of the J2PA.

This plan is available for review as an appendix to the Draft EIS for the Jonah Field II Natural Gas Project. Additional input from interested parties would be incorporated in annual operational updates to the plan (see Section A-5.0).

A-3.0 ROAD ROUTE DESCRIPTIONS

There are two paved all-weather roads, which would likely provide access to the TPA--U.S., Highway 191 and Wyoming State Highway 351. The remainder of the roads are not paved and generally are not surfaced (e.g., gravel, aggregate). Some of these unpaved roads become impassable when wet and during winter, and if used as access for this project, would require improvements and increased maintenance, including snow removal. In addition, some realignment of these routes may occur to minimize impacts to sensitive resources, to ensure safety, and to maximize traffic flow efficiency. Map A-3.1 and the maps available for review at area BLM offices show the preliminary location of potential access routes and/or corridors (i.e., collector and local road routes with high initial traffic volumes) on the TPA. Where no suitable road currently exists, a corridor is shown in which the proposed access road would likely be located.

The following sections briefly describe the location and status of proposed road routes on the TPA that may be used to access the J2PA and in-field development sites. New roads and necessary improvements and realignments to existing routes would be specified in annual operational updates and all routes would be selected to ensure safety, maximize transportation efficiency, avoid sensitive environmental resources, and minimize road densities.

A-3.1 U.S. HIGHWAY 191

U.S. Highway 191 is the primary transportation corridor currently linking the J2PA (at the Luman Road) to regional communities (e.g., Pinedale, Rock Springs). While no improvements or upgrading are anticipated for this route, a turnout lane is proposed for construction in 1997 at its junction with the Luman Road. Any future access points (e.g., northeast and southeast access corridors) along Highway 191 must consider sight distances and turnout lanes. These action would be coordinated with the Wyoming Department of Transportation (WDOT).

A-3.2 WYOMING STATE HIGHWAY 351

Wyoming State Highway 351 runs east-west approximately 6 mi north of the J2PA. This road provides access to the J2PA via the Burma Road for the traffic traveling from the Big Piney/Marbleton area. No improvements currently are anticipated for Highway 351, but the need for improvements may be identified in the future. Turnout lanes and sight distances would be considered at the Burma Road junction and any future access points (e.g., northeast access corridor), and this action would be coordinated with the WDOT.

A-3.3 LUMAN ROAD

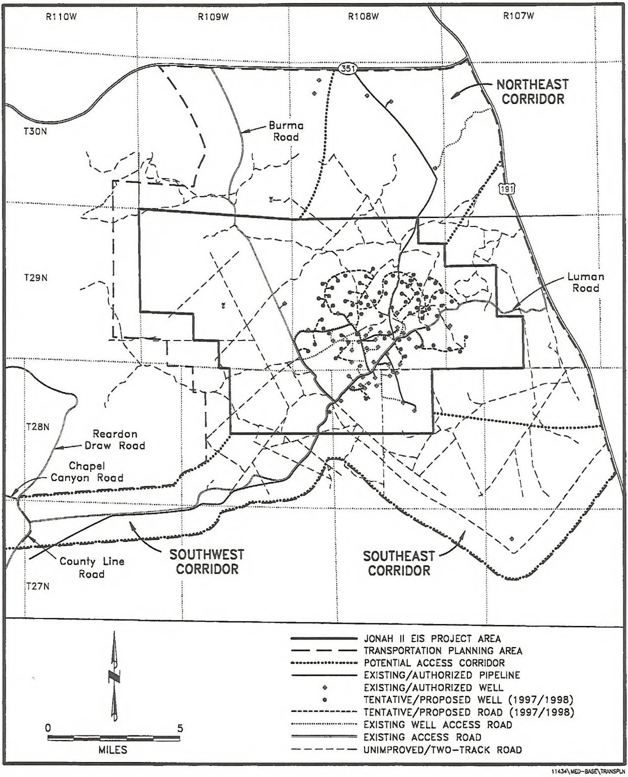
The existing, unpaved Luman Road links the J2PA to U.S. Highway 191 east of the area and is the primary field access route. This road is proposed for upgrading to local/collector road status (including gravel surfacing) from its junction with Highway 191 to Section 5, T28N, R108W. Road improvements are anticipated to be complete in early 1997. Additional improvement/maintenance work on the Luman Road would be identified in annual operational updates. It is anticipated that at field abandonment the road would remain in an upgraded condition.

A-3.4 BURMA ROAD

The Burma Road extends from Wyoming State Highway 351 south into the J2PA. Initial development plans indicated that this road would be upgraded to collector road status; however, current development plans indicate that this upgrade may be unnecessary. Therefore, only existing undesirable sections of the road (e.g., low water crossings, steep slope areas) currently are slated for improvement. These improvements would be completed in 1997, and any additional road upgrades/improvements would be specified in annual operational updates. The ultimate status of this road (i.e., at field abandonment) would be much the same as it exists today; however, all improvements to the road are anticipated to remain.

A-3.5 NORTHEAST ACCESS CORRIDOR

As the J2PA is developed, additional field access may be required to the northeast, linking the area to either U.S. Highway 191 or Wyoming State Highway 351. The exact location of this potential route has not yet been determined; however, it is anticipated that if the road is necessary, it would be located along an appropriate route within the corridor shown on Map A-3.1. Careful planning of road location would be necessary to avoid sensitive resources (e.g., raptor nests, sage grouse leks, cultural sites). It is



Map A-3.1 Transportation Planning Area with Potential Access Corridors, Existing, and 1997/1998 Tentative/Proposed Roads.

anticipated that this road, if developed, would be entirely reclaimed following field abandonment unless there is an identified need for the road by other area users.

A 4-inch surface gas sales pipeline currently is present within this corridor (see maps available at the BLM offices and Map 2.3 in the EIS). This pipeline would be replaced with a larger buried gas pipeline during project development. Further detail on pipeline development is provided in Section 2.4.6 of the EIS.

A-3.6 SOUTHWEST ACCESS CORRIDOR

An additional access route southwest may be constructed as the J2PA is developed. The road would be located at an appropriate location within the corridor shown on Map A-3.1 and would link the J2PA with the existing County Line Road. Access to the J2PA along this potential route would be restricted to the Whelan Bridge near LaBarge to avoid increased traffic in Reardon and Chapel Canyons. At field abandonment, the entire route would be reclaimed to conditions approximating those currently existing in the area unless there is an identified need for the road by other area users.

Two subsurface gas sales pipelines currently are present with this corridor (see maps available at the BLM offices and Map 2.3 of the EIS). It is anticipated that these pipelines would be replaced with larger pipelines or an additional subsurface pipeline would be constructed within this corridor. Further detail on pipeline development is provided in Section 2.4.6 of the EIS.

A-3.7 SOUTHEAST ACCESS CORRIDOR

If an access road to the southeast is deemed necessary for the proposed project, it would be constructed at an appropriate location within the corridor shown on Map A-3.1. There are many unknowns associated with the need for a road within this corridor, including those of area livestock operators. Its precise location, if required, would be shown in annual operational updates. If developed, this route is not anticipated to be a primary access road to the field. At field abandonment, the entire road would be reclaimed unless there is an identified need for the road by other area users.

A-3.8 ADDITIONAL LOCAL AND RESOURCE ROADS

Additional local and resource roads would be constructed on the J2PA as necessary and specified in annual operational updates. Where these new roads are shown to duplicate existing two-track roads, the exiting two-track may be reclaimed. At field abandonment, it is anticipated that most, if not all, newly constructed local and resource roads would be reclaimed unless there is an identified need for the road by other area users.

A-4.0 EXISTING AND PROPOSED TRANSPORTATION NEEDS

A-4.1 THE EXISTING NETWORK

The existing transportation network on the TPA is shown on Map A-3.1. This system includes three primary access roads, the Luman Road which connects the J2PA to U.S. Highway 191 east of the area, the Burma Road which runs north from the J2PA to State Highway 351, and an unnamed road running southwest of the J2PA to the County Line Road. Historic use of the roads has been limited primarily to livestock operators. The principle current use of these and other roads in the area is for oil- and gas-related traffic; however, other users include grazing permittees and recreationists (e.g., hunters, ORV users, rockhounds, people seeking solitude in the wide open spaces). The existing transportation system is generally suitable for all current users.

The Luman Road is utilized by all user groups, receives more use by large vehicles than any other road on the area, and is the most heavily used road in the area. Virtually all the heavy vehicle traffic in the J2PA is for oil- and gas-related activities.

The Burma Road is traversed by all users but is not currently suited for all-weather travel or large vehicles. The road receives less use than the Luman Road; however, there is a moderate amount of heavy truck use from LaBarge, Big Piney, and Marbleton during dry weather.

Traffic accessing the J2PA from the southwest is similar in volume and vehicle size as that occurring on the Burma Road. This access route is well-suited for all-weather traffic; however, the road itself is not (i.e., it requires all-weather surfacing). Vehicles currently traveling this route may access the route from Whelan Bridge in LaBarge or from Five Mile Bridge south of Big Piney and west up Reardon or Chapel Canyons. Existing traffic primarily uses the Whelan Bridge.

Undesignated two-track roads also may be used to access the area. These routes are used primarily by grazing permittees and recreationists (e.g., ORV users, hunters, solitude seekers). Grazing permittees primarily use the two-tracks to access water developments on the TPA.

Two pipeline routes deliver gas from the J2PA. One line runs north through Sand Draw, while the other is located adjacent to the unnamed road running southwest of the J2PA (see Map 2.3 in the EIS and maps available at area BLM offices).

A-4.2 PROPOSED NETWORK USE/MODIFICATION

The stages of a typical trip necessary for the J2PA transportation system are listed below.

A. Main movement (i.e., U.S. and state highway lanes for workers with destinations terminating in the J2PA).
B. Transition (i.e., turnout lanes, where there is a change in travel speed).
C. Distribution/collection (i.e., oil/gas field unit or ranch access roads; collector and local roads).
D. Terminal access (i.e., well location access roads; resource roads).

When planning transportation facilities, all of the described traffic stages can be identified within the system, but any stage could be eliminated if not needed (e.g., intermediate stages may not be necessary). Each movement stage is handled by a separate facility designed specifically for its function. Identifying the stages helps to plan traffic flows.

The TPA transportation network is not anticipated to experience problems at traffic stage changes, due to the relatively low volume of expected traffic (Table A-4.1). However, a turnout lane is proposed for 1997 construction at the junction of U.S. Highway 191 and Luman Road. The distribution by distance of traffic stage changes within the J2PA also eliminates the probability of congestion when vehicles turn from collector or local roads to well access roads. The well access roads are dispersed far enough apart and the traffic volumes are low enough that traffic congestion would be unlikely. Although traffic volumes on J2PA roads generally would be low, heavy vehicles would use the roads throughout the LOP, and without road upgrades, some of these vehicles may become stuck during inclement weather periods, causing traffic flow problems. The critical vehicle for this project would be the workover rig.

The estimated traffic requirements for each well are provided in Table A-4.1. Construction, drilling, and

Table A-4.1 Vehicle Characteristics and Number of Trips.

Truck Type	Average Weight (x 1,000 lbs)	No. of Wheels	Average Speed	Round Trips per Location	Total Round Trips[1] (x 1,000)
PROJECT DEVELOPMENT					
Location/Road Construction					
Semi	74	18	20	3	1.3
Gravel/haul	48	10	20	33	14.8
Pickup	7	4	30	47	21.2
Drilling Operations					
Semi	60	18	20	22	9.9
Fuel and mud	48	10	20	15	6.8
Logging and water	20	6	20	23	10.4
Pickup	7-8	4	30	133	59.8
Completion and Testing					
Semi	74-80	18	20	8	3.6
Haul A	48	10	20	33	14.8
Haul B	44	10	20	60	27.0
Haul C	20	6	20	21	9.4
Pickup	7-8	4	30	23	10.4
Development Total				421	189.4
OPERATIONS[2]					
Workover rig[3]	90	18	20	2	0.9
Haul	48	10	20	500	225.0
Pickup	7-8	4	30	237	106.6
Operations Total				739	332.5

[1] Assumes 450 wells are drilled and completed as producers.
[2] Assumes a well life of 20 years.
[3] The workover rig vehicle would be the largest vehicle (i.e., critical vehicle) required for the project.

completion activities, which have the greatest traffic requirements for the proposed project (an estimated 421 round trips per well over a 44-day period), would most likely be concentrated within localized areas during the first 10-15 years as the project is developed. The maximum number of round trips per day is estimated to be approximately 150 vehicles, and most of these vehicles would access the field from the Luman Road.

Localized construction and drilling activity would temporarily place heavy demands on road servicing. Traffic demands would be high in areas where drilling and completion activities are occurring, but would be minimal within other areas of the J2PA. Once all wells have been completed, traffic requirements would be minimal for the remainder of the LOP (i.e., averaging less than 20 round trips per day). Nonetheless, J2PA roads would be used continually until all wells in the area are abandoned and disturbed areas reclaimed.

A-4.3 ULTIMATE ROAD DISPOSITION

When the field is ready for abandonment (estimated to be approximately 40-50 years), the transportation network within the TPA would be reclaimed to appear much as it did prior to the development of oil and gas reserves in the area. Reclamation protocol are described in Appendix B of the EIS. Improvements to most existing roads likely would be maintained, and some roads identified as necessary or desirable for other area users (e.g., grazing permittees, recreationists) during annual operational updates may be retained.

Resource roads that may be retained after the LOP would be those that were identified during annual transportation planning as duplicating an existing two-track or other low traffic volume road for which these two-tracks or other roads were reclaimed. In addition, resource roads that are deemed necessary by the BLM for other area uses also may be retained.

The Luman Road likely would be retained in an upgraded status (local/collector road), as would improvements to the Burma Road. All other local/collector roads potentially developed as access routes for this project (i.e., potential roads in the northeast, southeast, and southwest corridors) are likely to be entirely reclaimed or returned to conditions similar to those occurring on the area prior to oil and gas development activities.

Road use following project completion likely would be limited to two of the three existing uses (i.e., grazing management and recreation), and responsibility for maintenance of roads would revert back to the BLM. A determination regarding the extent of post-project road maintenance (e.g., winter snow removal) on the TPA cannot be determined at this time since the level of future area use is unknown. Decisions would be made during the later years of the project based on public input received during annual update reviews.

A-5.0 ANNUAL OPERATIONAL UPDATES

Annual operational updates for the J2PA would begin in 1997 and annual updates would be available in January in each year thereafter until the project is completed or until the transportation system is so well established that further annual planning is not needed. Annual transportation planning would be conducted to determine the location and design criteria for roads to be developed on the area. This process would involve annual Operator projections for well and ancillary facility developments, public input, and updates on sensitive resources. With this information, the BLM would design a road network that accommodates Operator and other area user needs and minimizes potential impacts to sensitive environmental resources.

Operators would be required to provide to the BLM annual projections specifying proposed well and facility site locations and associated traffic requirements (e.g., estimated number of round trips; duration of construction, drilling, and completion activities; vehicle sizes) by October 15 of each year for the LOP (Table A-5.1). The BLM would evaluate this information, as well as known environmental constraints and other known uses of the area to develop tentative road locations and design criteria. A draft update with maps would be developed by the BLM and submitted to area Operators and other relevant land users by November 15 of each year. A meeting would be held with the Operators and other interested land users to discuss modifications to the proposed update to accommodate Operator and other user concerns, and public meetings would be held as deemed necessary by the BLM. All comments to the proposed annual operational updates would be received prior to December 15 of each year. A final update that considers all comments would be prepared and available for review in January of each year. Annual operational updates would be available for review at the BLM PRA and Rock Springs District Offices.

Geographic information system (GIS) technologies would be used to assist in the annual updating of the transportation network, as appropriate. Maps would be updated to incorporate new information (e.g., sensitive resource locations, existing and proposed road, well, pipeline, and ancillary facility locations). Existing roads designated for reclamation also would be identified. The BLM would make every effort to minimize the density of roads on the area while accommodating all land user requirements.

Information to be included in annual operational updates would include:

- the location of all existing wells, roads, pipelines, and other man-made features on the area;
- the location of all proposed wells, roads, pipelines and other project-required features to be developed within the next year;
- the location of all roads to be reclaimed during the next year;
- the anticipated traffic requirements for all existing and proposed developments;
- road types commensurate with BLM requirements (BLM 1985, 1991a) and proposed uses for all existing and newly developed roads on the area;
- identification of existing roads that require upgrades to accommodate existing and proposed traffic requirements;
- surfacing material source locations for road upgrades and maintenance; and
- the location of sensitive resources (e.g., drainages, raptor nest and sage grouse lek buffers) and environmental obstacles (e.g., steep slopes, erosive soils) (The precise locations of some environmentally sensitive resources [e.g., cultural and paleontological resource sites, raptor nests] may not be presented in reports to avoid unauthorized use; however, the locations of these resources and associated buffers would be considered during the planning process).

The final road route location and design criteria for all roads on the area would be included in APD and/or ROW applications, and would be subject to independent environmental reviews and National Environmental Policy Act analysis by the BLM. Some modification to proposed road locations specified in annual updates likely would occur as a result of these environmental analyses. Once a road has been constructed, its final location would be identified on maps in the annual operational updates.

During the later years of the project (years 20-50), it is anticipated that annual updates primarily would identify well locations and roads designated for

Table A-5.1 Annual Operational Update Responsibilities and Dates.

Action	Responsibility	Submittal/ Completion Date
Provision of information regarding annual proposed well, road, and facility site locations with traffic requirements and wells and roads to be abandoned	Operators	October 15
Evaluation of proposed plans	BLM, Operators	October 31
Draft update with maps prepared	BLM	November 15
Draft update review and public meetings	BLM, Operators, other interested parties	Late November - early December (as necessary)
Comment incorporation	BLM	December 15
Final update completion	BLM	January

abandonment and reclamation. The ultimate traffic network on the TPA is anticipated to appear much like the area appeared prior to natural gas development. However, public input received during the annual update process may recommend that some roads developed for the proposed project remain after the LOP. Roads that remain after the LOP would become the responsibility of the BLM. In addition, it is assumed that road upgrades of primary access routes would remain, and that most resource roads developed for this project would be reclaimed unless they are determined necessary for other area uses as identified during annual planning.

A-6.0 ROAD CLASSIFICATIONS

A-6.1 FUNCTIONAL ROAD CLASSIFICATION, GENERAL

The general functional road classification used in this document classifies roads according to a hierarchy of traffic movement within a traffic system. This classification is described in BLM Manual Section 9113 (BLM 1985), and does not necessarily depend on road condition.

A-6.2 FUNCTIONAL ROAD CLASSIFICATION

The road classification system used in this document is based on the one currently used by the BLM. The unique attributes of the roads within the TPA require the use of one or more unpaved collector roads. Due to the scarcity of existing all-weather roads within the TPA and the large tracts of land, some of the graveled or dirt BLM roads would be classified as collector or local roads. For example, Luman Road is identified as a collector/local road (see Map A-1.1). This road corridor would be improved to collector/local road status to meet transportation needs.

The road classification described below is derived from the BLM Manual Section 9113 (BLM 1985, 1991a). Figure 2.4 in the EIS presents some of the design criteria for the three road types proposed for this project.

A. Collector Roads. These roads normally provide primary access to large blocks of land and connect with or are extensions of a public road system. Collector roads usually require application of the highest standards used by the BLM. The design speed is 30-50 mph and the subgrade width is a minimum of 24 ft (20-ft full surfaced travelway).

B. Local Roads. These minimum volume roads usually provide the internal access network within an oil and gas field. The design speed is 20-50 mph and the subgrade width is normally 24 ft (20 ft full surfaced travelway). Low volume local roads in broken terrain may be single lane roads with turnouts.

C. Resource Roads. These normally are spur roads that provide point access. Roads servicing individual oil and gas well locations usually fall within this classification. These roads have a design speed of 15-30 mph and are constructed to a minimum subgrade of 16 ft (12-ft minimum full surfaced travelway) with intervisible turnouts. The subgrade width of resource roads is 16-18 ft, depending on the depth of surfacing materials and the travel surface. All resource roads in the J2PA would be a minimum of 14 ft wide when surfaced.

D. Casual Use Routes. Casual use routes are those that have not been constructed or maintained. They are usually created by repeated travel along the same route over time, and are often called two-tracks.

The public roads in the J2PA include two BLM roads: the Luman and Burma Roads. There are also numerous undesignated casual routes (unimproved/two-track roads) on the area and Operator-maintained well access (resource) roads (Map A-3.1).

Many of the existing casual routes within the J2PA may be upgraded and used as resource or local roads for natural gas development activities. Future resource roads (i.e., low traffic volume roads) are not specifically identified in this document due to the lack of site-specific details for the proposed project. Resource roads and future local roads would be identified during localized area transportation planning and would be specified in annual operational updates.

Proposed high traffic volume roads and/or road corridors (collector and local roads) are identified within this document (Map A-3.1) and on the GIS maps available for review at area BLM offices. Resource, two-track, and other unimproved roads which currently provide access to one or more existing wells or other facilities are also shown on the maps, as well as sensitive resource areas and other avoidance areas.

Annual operational updates would be used to determine the type of road standard and design parameters for new and/or upgraded roads. Design parameters for the three road types proposed for this project (i.e., collector, local, and resource roads) are shown in Figure 2.4 of the EIS and would be commensurate with BLM 9113 Manual specifications

(BLM 1985, 1991a). No roads required for this project would have travel surface widths of less than 14 ft.

The Operators anticipate that all roads upgraded or developed for this project would be designed, constructed, and surfaced to provide all-weather access. However, some local and resource roads initially may be constructed without appropriate surfacing material and, therefore, may become impassable during inclement weather. Operators would assume the risk of denied access to facility sites during inclement weather on roads that become impassable, since the BLM may deny access to avoid resource damage during periods when roads are unsuitable for travel.

The annual update process would minimize the number of roads by utilizing the best routes for local roads. Appropriately located local roads would avoid sensitive environmental resources where possible, shorten the length of resource roads, and deliver traffic to collector roads efficiently.

A-7.0 ENVIRONMENTAL CONSTRAINTS

There are many natural obstacles (e.g., steep slopes, poor soils for road construction, sensitive resources) throughout the TPA that pose problems with road construction and development. This section discusses several of the more formidable obstacles. Additional areas of concern likely would be identified during annual transportation planning and during ROW application review processes. Although roads could be constructed through many of the obstacles, these areas would be avoided, where possible, to avoid resource conflicts and augmented construction costs. The maps available for review at area BLM offices show the locations of the following natural and/or physical obstacles.

A-7.1 TOPOGRAPHIC CONSTRAINTS

In addition to the topographic obstacles listed below, there are many small dry lake beds and low-lying areas, small drainage channels, rock outcroppings, steep slopes, etc., that would be considered when choosing transportation routes within and adjacent to the TPA.

A-7.1.1 Steep Slope Areas

Steep slope areas occur throughout the TPA, and these areas would be avoided where possible to minimize erosion, visual resource, and biological resource impacts. Notable steep slope areas present in the TPA include Blue Rim, Stud Horse and Teakettle Buttes, and Ross and Yellow Point Ridges (see maps available at area BLM offices).

A-7.1.2 Playas

One playa lake is known to occur on the TPA on private land in Section 32, T29N, R108W, in the J2PA. This playa and others located during application review processes would be avoided where possible during construction to protect these unique landscape features.

A-7.1.3 Large Drainages

Crossing drainages is expensive and can cause adverse impacts if crossings are not appropriately designed and constructed. When it is necessary to cross a large drainage, an appropriate bridge, culvert, or low water crossing would be selected and designed to handle at least a 10-year flood. In addition, drainages and adjacent areas often contain significant cultural resource sites. Efforts would be made to limit the number of crossings. Large drainages within the TPA include Sand Draw, North Alkaline Draw, Granite Wash, East and West Buckhorn Draws, and Long Draw.

A-7.2 SOIL CONSTRAINTS

Site investigations and soil evaluations provide valuable information on soil types and limitations of the materials encountered on a road project. The extent of sampling and testing work required depends on the type and size of the road and soils characteristics. Lower standard roads (e.g., some resource roads) generally would not require auger borings, test holes, or extensive testing. Visual examination is generally sufficient for low traffic volume roads that would not carry frequent heavy loadings and for roads that appear to have soil types well-suited to road construction. Soils that generally cause problems are loose windblown sand, silt, and clay (fine-grained materials without the presence of gravel or rocky material). Fine-grained silts or clays are particularly troublesome when saturated. Sands cause problems when dry. The locality of known areas with stabilized sand dunes (i.e., sandy soil areas) are shown on Map 3.1 of the EIS.

Sands, silts, and clays may be difficult to distinguish when in combination, and intermediate silts have some characteristics of both sands and clays. Roads constructed on poor soils may perform well immediately after construction but then may lose stability by bearing failure (sand) or become too slippery or unable to support loads (clay) when wet.

Classifying soil types at proposed construction sites is valuable in predicting potential surface damage and determining the need for and type of surfacing material. Laboratory testing to determine the structural values of the soil may be advisable on roads requiring high traffic volumes and/or repeated heavy loads. Soils would be classified prior to road construction and specified with appropriate construction criteria in annual operational updates and/or ROW applications.

Known soils present on the J2PA are shown on maps available at area BLM offices. Most soils within the TPA have limitations for road construction, shallow excavations associated with pipeline construction, pond reservoir areas (reserve pits), and reclamation. Limitations were identified using criteria obtained from the U.S. Soil Conservation Service *National Soils Handbook, 603.15* (Soil Survey Staff 1983) (Tables A-7.1 through A-7.4).

Major soils within the TPA include the Garsid-Monte Association on 1-6% slopes; the Garsid-Terada-Langspring Variant complex on 0-6% slopes; the Vermillion Variant-Seedskadee-Fraddle complex on 0-3% slopes; and the Haterton-Garsid complex on 1-8% slopes. These mapping units collectively cover approximately 60% of the J2PA and occur extensively throughout the central and southern portions of the TPA. Limitations associated with these principal soils include shallow depth to rock, alkalinity, low strength, stoniness, excess lime, and shrink-swell potential (Tables A-7.5 and A-7.6). Steep slopes may limit development and reclamation potential in localized areas (Table 3.5 in the EIS), but these soils are typically located on gently sloping, undulating uplands.

Soils in the northwestern, north-central, and eastern portions of the J2PA occur in a complex mosaic across dissected topography, badlands, and streams. The Horsely-Badlands-Boltus complex on 15-65% slopes occupies dissected areas where the water erosion hazard is severe and soils are limited by shallow depths, low strength, and steep slopes (Tables A-7.6 and A-7.7 and Table 3.5 in the EIS). The Dines-Clowers-Quealman association on 0-3% slopes and the Monte-Leckman complex on 1-6% slopes occur adjacent to stream channels and on terraces and alluvial fans. These soils are limited by alkalinity, salinity, shrink-swell potential, stoniness, excess sand, and low strength.

Several associations (i.e., the Terada-Huguston-Fraddle, Monte-Leckman, Fraddle-Tresano, Huguston-Horsely-Terada, Garsid-Monte, Kandaly-Terada-Huguston, and Baston-Boltus-Chrisman complexes/associations) may be good sources for topsoil (see Table A-7.6). The Spool Variant-Ouard Variant-San Arcacio Variant, Fraddle-Ouard-Sand Arcacio Variant, and San Arcacio-Saguache complexes/associations may be good gravel sources (see Table A-7.6).

A-7.3 BIOLOGICAL CONSTRAINTS

Known sensitive biological resources present in the TPA include sage grouse leks, raptor nests, pronghorn antelope migration corridors, and various habitats suitable for threatened, endangered, and other sensitive species. As with other environmental constraints, these resource locations and their associated buffers, would be avoided, where possible, to minimize disturbance. In addition, inventories and monitoring of these resources would be conducted as specified in Appendix D of the EIS. The approximate known locations of these resources are shown on maps available for review at area BLM offices, and annual updates to this transportation plan would include updated, site-specific information on the location of these resources.

A-7.4 OTHER ENVIRONMENTAL CONSTRAINTS

Numerous paleontologic and cultural resource sites are known to exist on the J2PA. These sites would be avoided where possible during road improvement and construction activities. In addition, surveys for these resources would be conducted prior to construction, and monitoring of construction sites would be implemented as appropriate during development to avoid unnecessary disturbance.

Water developments (i.e., reservoirs, wells, and pipelines) occur throughout the TPA, and these locations are important for livestock and wildlife on the area. Roads developed and/or improved as a result of this project would avoid these locations, where possible, to minimize adverse effects to livestock and wildlife resources.

Table A-7.1 Criteria to Establish Soil Suitability for Drastically Disturbed Areas.[1]

	Rating[2]			
Parameter	Good	Fair	Poor	Restrictive Feature
Soil reaction (pH)	5.6-7.8	5.0-5.5 8.5-9.0	<5.0 >9.0	Too acid Too alkaline
Salinity (mmhos/cm)	0-8	8-16	>16 >8	Excess salt
Depth to cemented pan (inches)	>40	20-40	<20	Reclamation problems
Texture[3]	SL, L, SIL, SCL, VFSL, FSL, CL, SICL (<35% C)	CL, SICL, SC LS, LFS, LVFS	C, SIC, S, FS, VFS	Too clayey Too sandy
Soil adsorption ratio	0-5	5-12	>12	Excess sodium
Depth to bedrock (inches)	>40	20-40	<20	Reclamation problems
Erosion factor	<0.35	>0.35	>0.35	Erodes easily
Wind erodability group			1, 2	Soil blowing
Coarse fragments (% wt)				
3-10 inches	0-15	15-35	>35	Small stones
>10 inches	0-3	3-10	>10	Large stones, reclamation problems

1 Adapted from Soil Survey Staff (1983).

2 A rating of good means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated fair can be vegetated and stabilized by modifying one or more properties. Topdressing with better material or application of soil amendments may be necessary for satisfactory performance. Material rated poor has such severe problems that revegetation and stabilization are very difficult and costly. Topdressing with better material is necessary to establish and maintain vegetation.

3 U.S. Department of Agriculture Texture.

S	Sand	FSL	Fine sandy loam
VFS	Very fine sand	SL	Sandy loam
FS	Fine sand	SIL	Silt loam
LVFS	Loamy very fine sand	CL	Clay loam
LFS	Loamy fine sand	SICL	Silty clay loam
LS	Loamy sand	SCL	Sandy clay loam
L	Loam	C	Clay
VFSL	Very fine sandy loam	SC	Sandy clay
		SIC	Silty clay

Table A-7.2 Criteria Used to Establish Suitability for Pond/Reservoir Areas.[1]

	Limits			
Property	Slight	Moderate	Severe	Restrictive Feature
Texture[2]	SIC, C, SICL, CL, SC, SCL	L, SICL, CL, SIL, FSL, VFSL	SL, FSL, LS, S, LFS, gypsum	Seepage, piping
Permeability (inches/hr) (20-60 inches)	<0.6	0.6-2.0	>2.0	Seepage
Depth to bedrock (inches)	>60	20-60	<20	Depth to rock
Depth to cemented pan (inches)	>60	20-60	<20	Cemented pan
Slope (%)	0-3	3-8	>8	Slope

[1] Adapted from Soil Survey Staff (1983). Pond/reservoir areas are areas that hold water behind a dam or embankment and, for this project, include reserve pits. Soils best suited to this use have a low seepage potential, which is determined by permeability and depth to fractured or permeable bedrock, cemented pan, or other permeable material. The soil is rated on its properties in the upper 60 inches as a natural barrier against seepage into deeper layers, without regard to cutoff trenches or other features that may be installed under the reserve pit. Excessive slope in the direction perpendicular to the axis of the pond embankment seriously reduces the storage capacity of the reservoir area. Furthermore, suitable sites may be difficult to find on slopes steeper than about 10%.

[2] U.S. Department of Agriculture Texture.

S	Sand	SIL	Silt loam
LFS	Loamy fine sand	CL	Clay loam
LS	Loamy sand	SICL	Silty clay loam
L	Loam	SCL	Sandy clay loam
VFSL	Very fine sandy loam	C	Clay
FSL	Fine sandy loam	SC	Sandy clay
SL	Sandy loam	SIC	Silty clay

Table A-7.3 Criteria Used to Establish Suitability for Roadfill.[1]

	Limits			
Property	Slight	Moderate	Severe	Restrictive Feature
Depth to bedrock (inches)	>60	40-60	<40	Area reclaim
Texture[2]	--	L, SIL, FSL, VFSL, SCL, SC, SICL	CL, C, SIC	Low strength
Layer thickness (inches)	>60	30-60	<30	Thin layer
Fracture $\geq$3 inches (wt %)[3]	<25	25-50	>50	Large stones
Depth to high water table (ft)	>3	1-3	<1	Wetness
Slope (%)	0-15	15-25	>25	Slope
Shrink-swell	Low	Moderate	High	Shrink-swell

1 Adapted from Soil Survey Staff (1983). Roadfill consists of soil material that is excavated from its original position and used in road embankments elsewhere. The evaluations for roadfill are for low embankments that generally are less than 6 ft in height and are less exacting in design than high embankments such as those along superhighways. The rating is given for the whole soil, from the surface to a depth of about 5 ft, based on the assumption that soil horizons will be mixed in loading, dumping, and spreading. Soils are rated as to the amount of material available for excavation, the ease of excavation, and how well the material performs after it is in place. Soil properties that affect the amount of material available for excavation are thickness of suitable material above bedrock or other material that is not suitable. The percent of coarse fragments more than 3 inches in diameter, the depth to a high water table, and the slope are properties that influence the ease of excavation. A high content of gypsum can cause piping or pitting. Some damage to the borrow area is expected, but if revegetation and erosion control are likely to be difficult, the soil is rated severe.

2 U.S. Department of Agriculture Texture.

L	Loam	SICL	Silty clay loam
VFSL	Very fine sandy loam	SCL	Sandy clay loam
FSL	Fine sandy loam	C	Clay
SIL	Silt loam	SC	Sandy clay
CL	Clay loam	SIC	Silty clay

3 Weighted average to 40 inches.

Table A-7.4 Criteria Used to Establish Suitability for Shallow Excavations.[1]

Factors Affecting Location and Use	Limits			
	Slight	Moderate	Severe	Restrictive Feature
Texture[2]	L, SIL, CL, SCL, SICL	SL, FSL, SI[3], SC, all gravelly types	C[4], SIC[4], S, LS, organic soils, all very gravelly types	
Soil drainage class	Excessive to well	Moderately well	Somewhat poorly to very poorly	Wetness
Depth to high water table (ft)	>6.0	2.5-6.0	<2.5	Ponding, wetness
Flooding	None, rare	None	Subject to flooding	Floods
Slope	<8%	8-15%	>15%	Slope
Depth to bedrock (inches)[5]	>60	40-60	<40	Depth to rock
Stoniness (classes)	0, 1	2	3, 4, 5	Stones
Rockiness (classes)	0	1	2, 3, 4, 5	Rocks

1 Adapted from Soil Survey Staff (1983).

2 U.S. Department of Agriculture Texture. If soil contains a thick fragipan, duripan, or other material difficult (but not impossible) to excavate with handtools, increase the limitation rating by one class unless it already is "severe."

S	Sand	CL	Clay loam
LS	Loamy sand	SICL	Silty clay loam
L	Loam	SCL	Sandy clay loam
FSL	Fine sandy loam	C	Clay
SL	Sandy loam	SC	Sandy clay
SIL	Silt loam	SIC	Silty clay
		SI	Silt

3 If soil will stand in vertical cuts like loess, reduce rating to "slight."

4 If friable like some kaolinitic clays, reduce rating to "moderate."

5 If bedrock is soft enough to excavate with ordinary handtools or light equipment such as a backhoe, reduce "moderate" and "severe" ratings by one class.

Table A-7.5 Soil Characteristics for Known J2PA Soils.[1]

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	Erosion Factors[3] WEG (Wind)	Erosion Hazard
100	15-65%	Horsley	Shale	0-3	L	7.4-9.0	2-4	.15	8	High
				3-9	L, CL, SCL	7.4-9.0	<16	.37	4L	--
				9+	Shale	--	--	--	--	--
		Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	.32	4	High
				11+	Shale	--	--	--	--	--
101	8-40%	Haterton	Shallow loamy	0-3	L	7.9-9.0	2-4	.37	5	Moderate
				3-12	L	7.9-9.0	2-4	.43	--	--
				12+	Siltstone	--	--	--	--	--
		Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	.32	4L	Moderate
				22+	Shale	--	--	--	--	--
		Tasselman	Shallow loamy	0-1	SL	7.4-9.0	2-4	.24	3	Moderate
				1-7	GR-SL, CN-SL, SL	7.4-9.0	2-4	.10	3	--
				7+	Hard sandstone	--	--	--	--	--
102	1-10%	Langspring Var.	Loamy	0-10	L	7.9-8.4	<2	.32	4L	Low
				10-22	CL, SCL, L, SL	8.5-9.0	<2	.32	--	--
				22-30	SCL, L, SL	7.9-8.4	<2	.32	--	--
				30+	Sandstone	--	--	--	--	--
		Langspring	Loamy	0-9	L	7.9-8.4	<2	.32	4L	Low
				9-26	SCL, L, SL	8.5-9.0	<2	.32	--	--
				26-40	SCL, L, SL	7.9-8.4	<2	.05	--	--
103	1-12%	Terada	Loamy	0-7	VFSL, FSL, LS	7.4-8.4	<2	.32	3	Low
				7-34	VFSL, FSL	7.4-9.0	<2	.32	--	--
				34+	Sandstone	--	--	--	--	--
		Huguston	Shallow loamy	0-9	SL, FSL	7.4-8.4	2-4	.32	2	Moderate
				9+	Soft sandstone	--	--	--	--	--
		Fraddle	Loamy	0-4	SL	6.6-7.8	<2	.24	3	Low
				4-22	SCL	6.6-7.8	<2	.28	--	--
				22-34	SL, SCL	7.4-8.4	2-4	.28	--	--
				34+	Soft sandstone	--	--	--	--	--
105	0-2%	Fluvents	Saline lowland	N/A	N/A	--	--	--	--	Low

Table A-7.5 (Continued)

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	Erosion Factors[3] WEG (Wind)	Erosion Hazard
106	1-6%	Monte	Loamy/	0-2	L	6.6-9.0	<2	.24	5	Low
			saline upland	2-60	CL, L, SL	7.9-9.0	<2	.24	--	--
		Leckman	Loamy/	0-3	FSL, VFSL	7.9-9.0	<2	.32	4L	Low
			saline upland	3-60	FSL, VFSL	7.9-9.0	<2	.32	--	--
108	0-3%	Dines	Saline upland	0-4	SIL	>7.8	8-16	.37	6	Low
				4-21	SIL, SICL	>8.4	8-16	.37	6	--
				21-60	SIL, SICL	>8.4	>16	.37	--	--
		Clowers	Loamy	0-1	L	7.9-9.0	4-8	.37	4L	Low
				1-60	CL	7.9-9.0	4-8	.49	--	--
		Quealman	Loamy	0-2	FSL, L, CL	7.4-8.4	<2	.32	3	Low
				2-60	SR-LS-L-FSL	7.9-9.0	<2	.37	--	--
110	1-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	.24	3	Low
				4-22	SCL	6.6-7.8	<2	.28	--	--
				22-34	SL, SCL	7.4-8.4	2-4	.28	--	--
				34+	Soft sandstone	--	--	--	--	--
		Tresano	Loamy	0-2	SL	6.6-7.8	<2	.24	3	Low
				2-16	SCL	6.6-9.0	<2	.24	--	--
				16-60	SL	7.4-8.4	2-4	.28	--	--
113	1-8%	Haterton	Shallow loamy	0-3	L	7.9-9.0	2-4	.37	5	Moderate
				3-12	L	7.9-9.0	2-4	.43	--	--
				12+	Siltstone	--	--	--	--	--
		Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	.32	4L	Moderate
				22+	Shale	--	--	--	--	--
114	1-8%	Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	.24	3	Low
				1-19	SCL	6.6-7.8	<4	.28	--	--
				19+	Shale-sandstone	--	--	--	--	--
		Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	.32	6	Low
				4-16	CL, C	7.4-9.0	<2	.37	--	--
				16+	Shale	--	--	--	--	--
		Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	.32	4	Moderate
				11+	Shale	--	--	--	--	--
116	6-30%	Huguston	Shallow loamy	0-9	SL, FSL	7.4-8.4	2-4	.32	2	Moderate

Table A-7.5 (Continued)

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	WEG (Wind)	Erosion Hazard
				9+	Soft sandstone	--	--	--	--	--
		Horsley	Shale	0-3	L	7.4-9.0	2-4	.15	8	Moderate
				3-9	L, CL, SCL	7.4-9.0	<16	.37	4L	--
				9+	Shale	--	--	--	--	--
		Terada	Loamy	0-7	VFSL, FSL, LS	7.4-8.4	<2	.32	3	Moderate
				7-34	VFSL, FSL	7.4-9.0	<2	.32	--	--
				34+	Sandstone	--	--	--	--	--
119	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	.32	4L	Low
				22+	Shale	--	--	--	--	--
		Monte	Loamy	0-2	L	6.6-9.0	<2	.24	5	Low
				2-60	CL, L, SL	7.9-9.0	<2	.24	--	--
120	1-12%	Kandaly	Sands	0-1	LFS, LS	7.4-8.4	<2	.32	2	Moderate
				1-60	FS, LS	7.4-8.4	<2	.28	--	--
		Terada	Loamy	0-7	VFSL, FSL, LS	7.4-8.4	<2	.32	3	Low
				7-34	VFSL, FSL	7.4-9.0	<2	.32	--	--
				34+	Sandstone	--	--	--	--	--
		Huguston	Shallow loamy	0-9	SL, FSL	7.4-8.4	2-4	.32	2	Moderate
				9+	Soft sandstone	--	--	--	--	--
121	1-6%	Garsid	Loamy	0-22	L, CL	7.4-9.0	2-4	.32	4L	Low
				22+	Shale	--	--	--	--	--
		Terada	Loamy/sandy	0-7	VFSL, FSL, LS	7.4-8.4	<2	.32	3	Low
				7-34	VFSL, FSL	7.4-9.0	<2	.32	--	--
				34+	Sandstone	--	--	--	--	--
		Langspring Variant	Loamy	0-10	L	7.9-8.4	<2	.32	4L	Low
				10-22	CL, SCL, L, SL	8.5-9.0	<2	.32	--	--
				22-30	SCL, L, SL	7.9-8.4	<2	.32	--	--
				30+	Sandstone	--	--	--	--	--

Table A-7.5 (Continued)

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	WEG (Wind)	Erosion Hazard
122	0-6%	Baston	Clayey	0-3	FSCL	8.0-9.0	<2	.37	3	Low
				3-28	C	>8.4	<4	.37	--	--
				28+	Shale	--	--	--	--	--
		Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	.32	4	Moderate
				11+	Shale	--	--	--	--	--
		Chrisman	Clayey/ saline upland	0-2	SIC, C, SICL	7.9-9.0	<2	.37	.4	Low
				2-60	SIC, C, SICL	>7.8	<4	.37	--	--
123	4-25%	Spool Variant	Shallow sandy	0-6	LFS, GR-SL	6.6-7.3	<2	.20	2	Moderate to high
				6-12	LFS, CN-LFS,	6.6-7.8	<2	.28	--	--
					GR-SL, GR-S	--	--	--	--	--
				12+	Sandstone	--	--	--	--	--
		Ouard Variant	Shallow clayey	0-4	CL, L	6.6-7.8	<2	.32	6	Moderate
				4-16	CL, C	7.4-9.0	<2	.37	--	--
				16+	Shale	--	--	--	--	--
		San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	.24	3	Low to moderate
				4-14	SCL, SL	6.1-8.4	<2	.28	--	--
				14-25	LCOS, COS, GRV-S	6.6-8.4	<4	.10	--	--
				25+	Soft sandstone	--	--	--	--	--
124	3-8%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	.24	3	Low
				4-22	SCL	6.6-7.8	<2	.28	--	--
				22-34	SL, SCL	7.4-8.4	2-4	.28	--	--
				34+	Soft sandstone	--	--	--	--	--
		Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	.24	3	Low
				1-19	SCL	6.6-7.8	<4	.28	--	--
				19+	Shale-sandstone	--	--	--	--	--
		San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	.24	3	Low
				4-14	SCL, SL	6.1-8.4	<2	.28	--	--
				14-25	LCOS, COS, GRV-S	6.6-8.4	<4	.10	--	--
				25+	Soft sandstone	--	--	--	--	--

Table A-7.5 (Continued)

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	Erosion Factors[3] WEG (Wind)	Erosion Hazard
125	0-3%	San Arcacio	Sandy/loamy	0-3	SL, COSL	6.6-8.4	<8	.24	3	Low
				3-14	SCL, SL	6.6-8.4	<2	.28	--	--
				14-60	GRV-S, GR-SL, LCOS	7.4-8.4	<4	.10	--	--
		Saguache	Loamy/sandy	0-6	SL, COSL, GR-SL	6.6-9.0	<2	.15	5	Low
				6-60	GRV-S, COS, GRV-LS	6.6-9.0	<2	.05	--	--
126	1-6%	Kandaly	Sands	0-1	LFS, LS	7.4-8.4	<2	.32	2	Moderate
				1-60	FS, LS	7.4-8.4	<2	.28	--	--
		Boltus	Shale	0-11	C, CL	7.9-9.0	8-16	.32	4	Moderate
				11+	Shale	--	--	--	--	--
127	0-3%	Vermillion Variant	Shallow loamy	0-3	L	6.6-8.4	<2	.37	4L	Low
				3-8	CN-L, CN-CL	7.4-8.4	<4	.15	--	--
				8-27	FLX-L, FLV-CL, FLV-L	7.9-8.4	<4	.10	--	--
				27+	Hard mudstone	--	--	--	--	--
		Seedskadee	Shallow loamy	0-14	SCL, L, SL	7.0-8.5	<2	.24	3	Low
				14+	Hard sandstone	--	--	--	--	--
		Fraddle	Loamy	0-4	SL	6.6-7.8	<2	.24	3	Low
				4-22	SCL	6.6-7.8	<2	.28	--	--
				22-34	SL, SCL	7.4-8.4	2-4	.28	--	--
				34+	Soft sandstone	--	--	--	--	--

Table A-7.5 (Continued)

Map Unit No.	Slope	Map Unit Component	Range Site	Depth (inches)	Texture[2]	Reaction pH	Salinity (mmhos /cm)	Erosion Factors[3] K (Water)	Erosion Factors[3] WEG (Wind)	Erosion Hazard
128	0-3%	Fraddle	Loamy	0-4	SL	6.6-7.8	<2	.24	3	Low
				4-22	SCL	6.6-7.8	<2	.28	--	--
				22-34	SL, SCL	7.4-8.4	2-4	.28	--	--
				34+	Soft sandstone	--	--	--	--	--
		Ouard	Shallow loamy	0-1	SL, SCL	6.6-7.8	<2	.24	3	Low
				1-19	SCL	6.6-7.8	<4	.28	--	--
				19+	Shale-sandstone	--	--	--	--	--
		San Arcacio Variant	Loamy	0-4	SL	6.6-8.4	<8	.24	3	Low
				4-14	SCL, SL	6.1-8.4	<2	.28	--	--
				14-25	LCOS, COS, GRV-S	6.6-8.4	<4	.10	--	--
				25+	Soft sandstone	--	--	--	--	--

1 Adapted from ERO Resources Corporation (1988).

2 U.S. Department of Agriculture Texture.

S	Sand	L	Loam	CL	Clay loam
FS	Fine sand	VFSL	Very fine sandy loam	SICL	Silty clay loam
COS	Coarse sand	FSL	Fine sandy loam	FSCL	Fine sandy clay loam
LFS	Loamy fine sand	SL	Sandy loam	SCL	Sandy clay loam
LS	Loamy sand	COSL	Coarse sandy loam	C	Clay
LCOS	Loamy coarse sand	SIL	Silt loam	SIC	Silty clay

Texture Modifier:

CN	Channery	GR	Gravelly
FLV	Very flaggy	GRV	Very gravelly
FLX	Extremely flaggy	SR	Stratified

3 K = water erosion factor; WEG = Wind Erodibility Group.

Table A-7.6 Use Ratings and Limitations for J2PA Soils.[1]

Soil Series	Roadfill	Pond Reservoir Areas[2]	Shallow Excavations[2]	Bedrock Depth (inches)	Bedrock Hardness	Hydrologic Group	Limitations	Comments
Baston	Poor-area reclaim, low strength, shrink-swell	Mod-depth to rock	Mod-depth to rock, too clayey	20-40	Soft	D	High pH, low strength, shrink-swell, depth to rock.	
Boltus	Poor-thin layer, area reclaim, low strength, slope	1-8%: Sev-depth to rock. >8%: Sev-slope	Sev-too clayey	4-20	Soft	D	Shrink-swell, high pH, depth to rock, salinity.	
Chrisman	Poor-low strength	Slight	Sev-too clayey	>60	N/A	D	Shrink-swell, high pH, low strength.	
Clowers	Good	Mod-seepage	Slight	>60	N/A	C	High pH, salinity, low strength.	
Dines	Poor-low strength	Slight	Slight	>60	N/A	B	Shrink-swell, salinity, low strength	
Fraddle	Poor-thin layer	Mod-slope, depth to rock, seepage	Mod-depth to rock	20-40	Soft	B	Shrink-swell, depth to rock, low strength.	
Garsid	Poor-thin layer, area reclaim, slope	Mod-slope, depth to rock, seepage	1-15%: Mod-slope >15%: Sev-slope	20-40	Soft	C	High pH, depth to rock, low strength.	
Haterton	Poor-depth to rock, slope	1-8%: Sev-depth to rock. >8%: Sev-slope	Sev-depth to rock, slope >15%	10-20	Soft	D	High pH, depth to rock	
Horsley	Poor-depth to rock, slope	Sev-depth to rock, slope	Sev-depth to rock, slope	3-10	Soft	D	Shrink-swell, high pH, depth to rock, low strength.	
Huguston	Poor-depth to rock, slope	1-8%: Sev-depth to rock. >8%: Sev-slope	0-15%: Mod-depth to rock >15%: Sev-slope	4-20	Soft	D	Depth to rock,	
Kandaly	Good	2-8%: Sev-seepage >8%: Sev-slope	Sev-too sandy, cutbanks cave	>60	N/A	A	Too sandy.	
Langspring	Good	1-3%: slight 3-8%: Mod-slope >8%: Sev-slope	Slight	>40	Soft, rippable	B	High pH, stones, low strength.	
Langspring Variant	Good	1-3%: slight 3-8%: Mod-slope >8%: Sev-slope	Mod-depth to rock	20-40	Soft, rippable	B	High pH, depth to rock, excess lime, low strength.	

Table A-7.6 (Continued)

Soil Series	Roadfill	Pond Reservoir Areas[2]	Shallow Excavations[2]	Bedrock Depth (inches)	Bedrock Hardness	Hydrologic Group	Limitations	Comments
Leckman	Good	Mod-seepage	Mod-sandy	>60	N/A	B	High pH, too sandy, stones, low strength.	
Monte	Good	Slight	Slight	>60	N/A	B	High pH, low strength.	Good source for topsoil
Ouard	Poor-thin layer	Sev-depth to rock	Mod-depth to rock	10-20	Soft	D	High pH, depth to rock, low strength.	
Ouard Variant	Poor-thin layer, low strength, area reclaim	Sev-depth to rock	Mod-depth to rock	10-20	Soft	D	Shrink-swell, high pH, depth to rock, too clayey, low strength.	
Quealman	Good	Mod-seepage	Mod-sandy	>60	N/A	B	High pH, too sandy, stones, low strength.	
Saguache	Good	Sev-seepage	Sev-too sandy	>60	N/A	B	High pH, stones, low strength.	Gravel source
San Arcacio	Good	Sev-seepage	Sev-too sandy	>60	N/A	C	Shrink-swell, stones	Gravel source
San Arcacio Variant	Good	Sev-seepage	Mod-depth to rock, sandy	20-40	Soft	C	Shrink-swell, depth to rock, stones.	Gravel source
Seedskadee	Poor-thin layer	Sev-slope, depth to rock, seepage	Mod-depth to rock	10-20	Rippable	C	Depth to rock, stones	
Spool Variant	Poor-area reclaim, depth to rock, slope	4-8%: Sev-depth to rock >8%: Sev-slope	Sev-depth to rock, slope	3-20	Soft	C	Depth to rock, too sandy, stones.	
Tasselman	Poor-thin layer, area reclaim, slope	Sev-slope, depth to rock	Sev-depth to rock, slope	5-20	Hard	D	High pH, depth to rock	
Terada	1-15%: Good; 15%: Fair-slope	1-8%: Mod-seepage; slope; >8%: Mod-slope	1-8%: Slight 8-15%: Mod-slope	20-40	Soft	B	High pH, depth to rock, low strength.	Good source for topsoil in areas where slopes are 1-8%
Tresano	Good	1-3%: Mod-seepage; 3-8%: Mod-slope	Slight	>40	Soft	B	Shrink-swell, high pH, low strength.	Good source for topsoil.
Vermillion Variant	Poor-depth to rock	Mod-depth to rock	Mod-depth to rock, stones	20-40	Rippable	C	Depth to rock, stones, excess lime.	

1 Adapted from ERO Resources Corporation (1988).

2 Mod = moderate; Sev = severe.

A-8.0 ROAD SPECIFICATIONS, PLANS, AND MAINTENANCE

A-8.1 GENERAL REQUIREMENTS

In general, all roads to be built, improved, or rebuilt within the TPA would be developed according to the standards stated below for designed roads. Roads on state or private land within the area would be planned and built according to these same standards unless otherwise specified by private landowners. Where roads are not developed in accordance with BLM standards, the potential for adverse impacts to health and safety and sensitive environmental resources is increased.

Newly designed roads on federal lands or these requiring a federal undertaking would comply with the requirements of the BLM District Engineer. The District Engineer requirements draw on the BLM Manual Section 9113 - Roads (BLM 1985) and the associated Wyoming State Supplement (BLM 1991a), as well as other BLM Manual Sections. Design elements of the roads also would draw on the current American Association of State Highway and Transportation Officials (AASHTO), Manual on Uniform Traffic Control Devices (U.S. Department of Transportation Federal Highway Administration 1988), American Society for Testing Materials, and Wyoming State, and Sublette County design criteria, where appropriate.

In March of 1992, the Wyoming BLM adopted the *Wyoming State Supplement to the BLM Manual 9113* (BLM 1991a). This supplement amplifies several parts of the BLM Section 9113 (BLM 1985). Some of the information contained within this document is emphasized below:

> *In Wyoming, Bureau roads are designed, constructed, and/or upgraded for long-term use and are to be located, designed, and constructed to provide safety to the user and require the minimum amount of maintenance. Adequate design and construction of drainage structures, cut and fill slopes, and the travel-way will minimize future maintenance needs. The Bureau will not accept roads constructed by others which require excessive maintenance expenditures by the Bureau.*
>
> *A standard below the Resource Road classification may only be constructed for short duration use (30-60 days) and should not service traffic during the winter and spring months.*
>
> *In most cases, flat-bladed roads develop into canals and are a hazard to the user as well as creating environmental problems. Flat-bladed roads will not be authorized in Wyoming. The exception to this rule will be for the lowest class resource road where upgrading of short segments of an existing route is planned, i.e., excavating a hump for better site distance, widening a curve, etc.*

Where information in the BLM Manual dealing with roads and bridges seems inappropriate or hard to understand, the Rock Springs BLM District Engineer would be consulted for clarification.

The following standards are the minimum standards for all roads constructed on BLM lands in Wyoming. The standards are found within BLM (1985). These standards are values established to ensure adequate uniformity and quality of all roads constructed on lands administered by the BLM. Average daily traffic, vehicle types, and design speed determine the geometric standards to be applied.

A-8.2 TECHNICAL REQUIREMENTS FOR ROADS

Additional requirements for roads within the TPA are discussed below. Because each road is unique, it is not the purpose of this document to give all of the technical data that may be necessary for every road. Each road construction project would be evaluated with its own requirements and appropriate technical information obtained during the annual transportation planning processes and subsequently processed APDs and ROW applications.

BLM Manual Section 9113 (BLM 1985) and its Wyoming State Supplement (BLM 1991a) contain the comprehensive technical requirements necessary for the design of roads on Wyoming BLM administrated lands. A copy of applicable BLM Manual Sections can be obtained from the BLM Rock Springs District Office.

A-8.3 ROAD SURFACE MATERIAL

At this time, known road-surfacing material sources available for roads in the TPA are limited to three locations--two sand pits and one gravel quarry. Potential surface material sources on and adjacent to the area are shown on the maps available for review at area BLM offices. The need for additional surface aggregate sources is not anticipated for this project. If additional source locations are deemed necessary, they would be identified during the annual transportation planning process.

Many roads within the TPA are or would be built across sandy or clayey soils and would require surfacing material. Both sandy and clayey soils are subject to unique stability problems (see Section A-7.2), which can be remedied with the application of an aggregate surface. When surfacing aggregate is required for roads in the TPA, it would consist of appropriate material and gradations. Surface material would be applied to the minimum compacted depths that meet current BLM standards.

A-8.4 DRAINAGE CROSSINGS

Bridge, culvert, and low water crossing designs would conform to the BLM Manual Section 9112 (BLM 1990a), Wyoming State law, and standard engineering practices. Drainage structures can be placed on most of the drainages within the TPA using a U.S. Army Corps of Engineers (COE), Nationwide 404 Permit 14 (Road Crossings Sections 10 and 404). The COE would be consulted to obtain permits for crossing drainages, and it is anticipated that nationwide permit stipulations would be met under most circumstances. If the stipulations in Permit 14 cannot be met, a full standard 404 Permit would be required. The COE would be notified when construction of a road involves a drainage, even if all provisions of Permit 14 are met or flow in the drainage is intermittent. Usually a simple letter to and a reply from the COE would satisfy the requirement on small drainages. If there is any question about the need to obtain a COE permit or the type of permit necessary, contact with the Wyoming COE would be initiated (Wyoming Regulatory Office, U.S. Army Corps of Engineers, 2232 Dell Range, Suite #210, Cheyenne, WY, 82009, [307] 772-2300).

Culverts, bridges, or low water crossings would be installed wherever a road is constructed across a defined drainage or natural channel. Culverts would be designed to pass no less than a 10-year flood without developing static head at the entrance, as identified by a BLM hydrologist, engineer, or other similarly qualified individual. Calculations would be based on local soil types and other pertinent environmental data. The size and gradient of the culvert would be designed to avoid damage from a 25-year flood. Culverts smaller than 18 inches in diameter would not be used due to problems with cleaning and maintenance.

In addition to installing culverts in defined drainages to provide adequate cross drainage and to minimize erosion, cross culverts would be installed at appropriate spacings for lateral drainage. There are three major factors to consider when determining culvert spacing--gradient, soil type, and rainfall intensity. Other factors that effect drainage are frost and frozen ground, snow depth, groundwater depth, soil permeability, and evaporation rate. Recommended spacing of cross culverts for various gradients and soil types are given in the BLM Manual Section 9113 (BLM 1985). This is a good guide for most situations and would be used unless local experience dictates otherwise.

In some relatively flat areas with permeable, well-drained soils, a culvert may fill with sand and silt annually, providing no drainage. Culverts in areas with highly erosive soils have a tendency to wash out, leaving an impassable barrier. When past experience or soil and gradient conditions indicate potential problems with culverts, the best option may be to construct the road without cross drain culverts except on defined drainages and evaluate the drainage performance of the road and adjacent area. Raised roads with flat-bottomed ditches may be useful in poorly drained areas. If unacceptable amounts of water accumulate and do not dissipate within a reasonable period of time, corrective action would be taken. Such action may include installing a dip or low water crossing, or installing a culvert and evaluating its performance.

A-8.4.1 Culverts

Culverts are to be aligned with the natural drainage, and would comply with BLM Manual, Sections 9112 (1990a) and 9113 (1985) and the Wyoming State Supplement (1991a). Culverts would be installed as needed at all road intersections except when an

intersection occurs at the crest of a ridge. The minimum allowable culvert diameter is 18 inches. Culverts and structures would be strong enough to support a minimum of HS-20 loading (AASHTO specification) as required by BLM (1985).

A-8.4.2 Low Water Crossings

Low water crossings may be used with BLM approval, when necessary, as a type of drainage crossing where a 10-year runoff design produces more runoff than can be reasonably handled with a drainage structure or when the cost of a structure is unreasonable. Cost analysis, terrain and drainage features, structure stability, and necessary drainage diversions must be considered when determining the best alternative for crossing a drainage.

Environmental disturbance also must be considered. Drainage structures may not be the best environmental choice. Low water crossings, if constructed properly, may cause less short- and long-term environmental damage than a large structure with road approach fills, water backup, and downstream bed scouring. Low water crossings require continued maintenance to minimize erosion and allow vehicles to cross. Low water crossings should not be considered when there is a fishery or a water flow for more than just runoff periods. Low water crossings in drainages with flow tend to become impassable during winter months due to the freeze and thaw cycles. Trucks attempting to cross ice crusts over water may break through and may high-center on the ice.

A-8.4.3 Bridges or Structures

Bridges and major culverts constructed on public lands must conform to BLM standards as outlined in Bureau Manual Section 9112 (BLM 1990a), including design by or under the direction of a qualified registered professional engineer. These structures are unique and would be developed site specifically. Some structures, such as bridges, may need to be designed to carry heavier loads and would be considered individually at the time of construction. All bridges must have a minimum curb-to-curb or rail-to-rail width (whichever is less) of 14 ft for single lane roads and 24 ft for double-lane roads, but in all cases, not less than the nominal width of the adjacent travelway as measured at right angles to the travelway centerline. All structures would be designed for a minimum of a HS-20 loading.

A-8.5 ROAD LAYOUT AND CONSTRUCTION INSPECTION

Surveying and staking necessary for road construction or improvement would be done by or under the direction of proper Wyoming registered professionals (e.g., surveyors, engineers). The complexity of the project would govern the amount of work, design, and inspection necessary.

A-8.5.1 Centerline Staking

Surveyors have many methods used to lay out roads. At a minimum, the BLM requires that stakes be placed on the centerline of the road at a maximum distance of 100 ft; at all fence or utility crossings, and at all abrupt breaks in ground profile of vertical change of 1 ft or more. Stakes would be placed on the centerline of the road at a maximum distance of 50 ft around curves of 4° or sharper. The station or stake number would be written clearly on each stake. Section corner ties would be made and shown on all road design plans, as presented in applications. The BLM may require additional construction staking criteria as determined on an individual basis.

A-8.5.2 Construction Monitoring

Many access roads can be constructed without major inspection efforts. Roads without unusual construction requirements may, in some cases, be monitored by Operators. The extent and type of construction monitoring would be determined by the BLM for roads across BLM land.

Construction inspection insures the following.

- The route approved for construction is followed with as little environmental disturbance as practical.
- All sensitive environmental, paleontological, or cultural/historic sites are adequately protected.
- Construction methods properly remove organic matter from roadfill areas or fill material.
- Topsoil removal, stockpiling, and replacement and, in some instances, reseeding are conducted commensurate with approved design.

- Embankments meet proper width, slope, and compaction criteria. This may involve the use of water.
- Frost in the ground is not so excessive that it precludes proper construction.
- Reasonable efforts are made to walk equipment on the overall road surface to help with compaction.
- Drainage structure installation includes adequate compaction, rip-rap placement, drainage bowl installation, cover depths, wing ditch slopes and lengths, etc.
- Proper sign placement is used.

In some cases, the inspector may be required to certify that the construction was completed according the design parameters and standards specified in ROW applications. In this case, a Wyoming registered professional would provide to the BLM and relevant Operators a seal and signature on an affidavit of completion, according to the approved plans and specifications.

A-8.6 OTHER DESIGN GUIDELINES

The BLM Manual Section 9113 - Roads (BLM 1985) and its Wyoming Supplement (BLM 1991a), as well as other applicable manual sections would be the guides for design elements such as horizontal and vertical alignment, curve super elevation, cross section elements, earthwork design, drainage elements, cattle guards, sign and markers, sight distances, and staking.

The roadway structure which includes the subgrade, the sub-base course (in some cases), and the base course, or the base course used as a surface course, in the case of graded earth roads, must be strong enough to support HS-20 loadings (AASHTO specification) as required by BLM specifications or by engineer design, where design exceeds BLM minimum requirements.

The unique qualities of the particular road and its location govern how the structure is designed and built. In general, road surfacing varies in thickness according to various design factors.

All cattle guards or other structures are to have a minimum curb-to-curb or rail-to-rail width (whichever is less) of 14 ft for single lane roads and 24 ft for double-lane roads, but in all cases, not less than the nominal width of the adjacent travelway as measured at right angles to the travelway centerline. All structures would be designed for a minimum of a HS-20 loading.

A-8.7 MAINTENANCE

All roads on the project area would be maintained to BLM 9113 Manual specifications (BLM 1985, 1991a). Maintenance on collector roads is anticipated to occur at least twice per year, whereas local and resource road maintenance may be required only once annually. All roads required for the proposed project would be maintained as necessary to provide all-weather access (e.g., grading, surface material application, snow plowing), and Operators would be responsible for these maintenance actions. Maintenance agreements developed among Operators would be provided to the BLM (see Section A-9.1). Where roads become impassable, the BLM may deny access until the roads are repaired and/or the potential for resource damage is otherwise alleviated.

A-9.0 MAINTENANCE AGREEMENTS

Maintenance agreements are usually binding contracts between companies which deal with road maintenance. The BLM generally does not enter into maintenance agreements with companies. The preferred approach is for companies to work together and adjudicate maintenance agreements amongst themselves. Operators would provide the BLM with copies of all road maintenance agreements, including the name of a designated contact person. Non-oil and gas roads would be maintained by the BLM or other ROW holder.

Problems may occur with new companies in the area. Maintenance agreements must be revised to include the new user. If a company is the first to drill in an area, that company may be the sole road maintainer until other companies begin to access the area. Agreements would be reviewed and budgets for maintenance prepared yearly in association with the annual transportation planning process. Maintenance meetings would be held with all participants to review all road maintenance agreements. If a company only has a few roads, review may be made over the phone with other participants and then the contract can be mailed and notarized signatures obtained. When Operators or other area users propose new activity that would utilize part or all of an existing road, maintenance agreements for existing roads must be restructured to include the new users.

Maintenance agreements would contain grading and other maintenance schedules, participant responsibilities, and cost allocation. Agreements would describe response methods and primary and secondary emergency contacts for hazard maintenance.

Operator responsibilities for road maintenance can be divided into at least three types of agreements. The principle maintenance agreement type weights the maintenance cost share of each Operator according to the amount of projected use of the road. The projected use can be based on past use, number of producing wells and facilities down-road, and wet weather access needs. The maintenance contract would have each Operator's tallied amounts and commitments for the upcoming year. This agreement type would be the most commonly used on the J2PA. Other types of agreements involve Operators taking care of road maintenance on alternate time intervals or dividing a road into segments of near equal maintenance amounts and assigning each Operator maintenance responsibility for their segment of the road.

Snow removal often is considered as a separate item. Some Operators may not need access to sites during the winter months and may not participate in costs associated with snow removal. In some cases, roads may only need maintenance once or twice per year or at some other time interval.

A-10.0 LITERATURE CITED AND ABBREVIATIONS

A-10.1 LITERATURE CITED

Bureau of Land Management. 1985. Manual 9113-Roads. Engineering Rel. 9-247. U.S. Department of the Interior, Bureau of Land Management.

_____. 1990a. Bureau of Land Management Manual Section 9112.

_____. 1991a. Wyoming Supplement to the Bureau 9113 Manual. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office. 16 pp.

ERO Resources Corporation. 1988. Burma Road soil survey. Prepared for the U.S. Department of Interior, Bureau of Land Management, Pinedale Resource Area, Rock Springs District, by ERO Resources Corporation, Golden, Colorado. February 1988. 157 pp. + append.

Soil Survey Staff. 1983. National Soils Handbook and updates. U.S. Department of Agriculture (430-VI-NSH), Washington, D.C.

U.S. Department of Transportation Federal Highway Administration. 1988. Manual on Uniform Traffic Control Devices.

A-10.2 ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
APD	Application for Permit to Drill
BLM	U.S. Bureau of Land Management
COE	U.S. Army Corps of Engineers
EIS	Environmental Impact Statement
GIS	Geographic Information System
HS-20	Refers to the AASHTO truck type and axle load rating
J2PA	Jonah Field II Project Area
Operators	McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, Western Gas Resources, and other companies
ORV	Off-road vehicle
POD	Plan of Development
PRA	Pinedale Resource Area
ROW	Right-of-way
TPA	Transportation planning area
WDOT	Wyoming Department of Transportation

ADDENDUM A-A:

ACCESS PERMITS

ACCESS PERMITS

Whenever a proposed road is to access an existing state or county road, an access permit must be obtained prior to construction. When a pipeline or other utility will cross a state or county road, a license or permit is required. In general an application for an access permit includes the application form, fee, and plans and specifications. The plans and specifications shall show the location of the proposed construction with reference to a mile mark (state roads), the nearest city, or a well-defined point. The plans and specifications also include approach radius, roadway width, drainage structures, signing, profile and grades, surface material, and any other information required by the state or county with jurisdiction of the road. If the proposed access is on private land, a copy of the lease agreement with the private landowner and power of attorney to apply for access also should be submitted. The location of the proposed access should be flagged and marked so the state or county official considering the application can identify it for inspection. The official inspecting the location would approve or reject the application based on sight distance, proximity to other approaches or structures, and other factors. The Wyoming Department of Transportation, Sublette County Engineering Department should be consulted for current application forms, fees and design criteria for the proposed access.

Current information and fee rates may be obtained from:

Wyoming Department of Transportation
Rock Springs District Office
P.O. Box 1260
Rock Springs, Wyoming 82902
(307) 352-3000

Sublette County Planning and Zoning
21 South Tyler
Pinedale, Wyoming 82941
(307) 367-4375

Where roads cross another ROW such as a pipeline or other utility, the owner of the ROW must be contacted for requirements for constructing a crossing over the pipeline or utility ROW. The owner also should be given advance notice of construction to allow the owner or a representative to be present for inspection during construction.

The remaining pages in Addendum A contain sample Sublette County and Wyoming Department of Transportation access permit application forms.

SAMPLE
SUBLETTE COUNTY ACCESS PERMIT

APPLICATION FOR ACCESS DRIVEWAY ONTO COUNTY ROAD
SUBLETTE COUNTY, WYOMING

Date: ______________________ Permit No.: ______________________

Name: ____

Address: ____

Telephone: (home) ____________________ (office) ____________________

Application is hereby made to the Board of County Commissioners, Sublette County, Wyoming for a permit for access to a county road on property whose legal description is:

County road involved: ____

Type of access: (Circle one) Private, Commercial, Industrial, Subdivision, Other (explain).

Size and type of culvert to be used: ______________________________

____

Width of approach: ____

Submit a diagram showing the relation of access to property lines, county road, and any other roads within 1/4 mile

Access must meet all requirements as set forth in the Road Standards of Sublette County.

I, ______________________________, say that I am the owner of the property involved in this application. The foregoing statements and answers, and those in the attached plans and other exhibits, are true and correct to the best of my knowledge and belief.

Signed______________________________

Witness:

____

The foregoing application was _____approved _____denied on this _____ day of ______________________________, 19____.

____

Road and Bridge Foreman

SAMPLE
ACCESS PERMIT FORMS
FOR ALL AGENCIES

FORM M3

WYOMING DEPARTMENT OF TRANSPORTATION
ACCESS PERMIT

DATE OF APPLICATION ______________

The Undersigned hereby makes application for permission to construct an access driveway (s) described below and as shown on the attached sketch or plan "hereby made part of this application" to:

TO BE FILLED OUT BY THE PROPERTY OWNER

LOCATION OF PROPERTY:

HIGHWAY NO. ________ COUNTY ____________________ APPROXIMATELY ______________

MILES ________________________ FROM ______________________________,
N.S.E.W.

FOR INGRESS OR EGRESS TO A ______________________________
RESIDENCE OR BUSINESS AND TYPE

ACCESS DRIVE, ON ____________ SIDE OF HIGHWAY, PROPOSED DRIVEWAY.
N.S.E.W.

AGREEMENT:

I, the Undersigned property owner, request permission to construct an access driveway (s) on public right-of-way at the above location, subject to the restrictions and regulations contained in the "RULES AND REGULATIONS FOR ACCESS DRIVEWAY (S) to WYOMING STATE HIGHWAYS" current edition. In consideration of these regulations, the applicant agrees:

1) To construct driveway(s) in a safe manner so as not to interfere with or endanger public travel and to perform all work in a neat and workmanlike manner, to use materials acceptable to the Department of Transportation and to leave the right-of-way clean and in a condition equal to or better than the original condition.

2) To fully protect the traffic on the highway during construction covered hereunder by proper barricades, flagman, and/or signs as shown in the Traffic Control for Roadway Work manual, and to hold harmless the Wyoming Department of Transportation, its officers and employees from all dangers, expenses claims or liability arising out of any alleged damages of any nature to any person or property, due to the construction performance or nonperformance o work, or existence of said driveway.

3) That no driveway(s) shall be constructed such that there will be parking or servicing of vehicles within the highway right-of-way.

4) That the profile grade of driveway(s) shall be constructed as indicated on the attached sketch or plan and shall in no case be graded or maintaine such that water will drain onto the highway surface.

5) That this permit becomes VOID if construction is not completed within ________ days after the initiation of construction or one year after th date of approval if no construction has been done.

6) That any change in land use which would generate greater traffic volumes would nullify this agreement for access and a new application must b submitted.

7) That the Wyoming Department of Transportation reserves the right to inspect these installations at the time of construction and at all times thereafte until accepted by the Department, and to make changes at any time necessary to provide protection of life and property on or adjacent to the highway Once an approach/access has been accepted by the Department it becomes the Department's to maintain and repair except for snow or debris removal.

8) To any additional requirements as sent forth under DISTRICT ENGINEERING REQUIREMENTS/COMMENTS on reverse side, and/or any on the sketch or plans.

APPLICANT ______________________ ADDRESS ______________________
(PRINT)

FIRM NAME ______________________ CITY ____________ STATE _____ ZIP ________

PHONE NUMBER (   ) ______________________ SIGNATURE ______________________

Revised: June 1993

FORM M3

DESCRIPTION FOR WYOMING DEPARTMENT OF TRANSPORTATION USE ONLY

ROAD SECTION ____________________, MILEPOST ____________________,

ROADWAY CLASSIFICATION ____________________, RIGHT OR LEFT STATION ____________________,

PROJECT ____________________, SECTION ____________________,

TOWNSHIP ____________________, RANGE ____________________,

____________ FT, AND ____________ FT, SURFACE TYPE ____________________,
WIDTH RADIUS

DRAINAGE STRUCTURE REQUIRED YES/NO, LENGTH ____________________, TYPE/SIZE ____________________,

SLOPE ____________ AND OR VALLEY GUTTER TO BE LOCATED ____________ FEET FROM THE SHOULDER LINE.

RIGHT OF WAY FROM CENTERLINE OF HIGHWAY ____________________ FEET.

RIGHT-OF-WAY-DIVISION PERMIT NO. ____________________

ACCESS CONTROL: FULL ____________________ LIMITED ____________________

NONE ____________________ NONE ASSUMED ____________________

SIGNATURE ____________________ TITLE ____________________ DATE ____________

DISTRICT ENGINEERING:

PRELIMINARY FIELD INSPECTION BY ____________________ DATE ____________
(INCLUDE TITLE)

REQUIREMENTS/COMMENTS:

SIGNATURE ____________________ TITLE ____________________ DATE ____________

APPROVAL FOR CONSTRUCTION:

THE ABOVE APPROACH PERMIT IS GRANTED, WITH THE CONDITIONS STATED HEREIN THE _____ DAY OF ____________, A D 19 ___

WYOMING DEPARTMENT OF TRANSPORTATION BY: ____________________
DISTRICT ENGINEER/DISTRICT TRAFFIC ENGINEER

CONSTRUCTION INSPECTION:

I HAVE INSPECTED THE ACCESS DRIVEWAY(S) AND HAVE FOUND THE ACCESS(ES) TO BE CONSTRUCTED AS PER THE REQUIREMENTS ON THIS APPLICATION.

SIGNATURE ____________________ TITLE ____________________ DATE ____________

ACCESS ACCEPTANCE:

DISTRICT PERSONNEL HAVE INSPECTED THE ACCESS DRIVEWAY(S) DESCRIBED ON THIS APPLICATION AND ATTACHED DRAWING(S) AND HAVE FOUND THE ACCESS DRIVEWAY(S) TO BE CONSTRUCTED IN THE MANNER AS PRESCRIBED ON THIS APPLICATION AND ATTACHED DRAWING(S).

____________________________________ ____________________
DISTRICT ENGINEER/DISTRICT TRAFFIC ENGINEER DATE

REFERENCES: OPERATING POLICY 21-1/RULES & REGULATIONS FOR ACCESS DRIVEWAYS TO WYOMING STATE HIGHWAYS

APPENDIX B:

RECLAMATION PLAN

RECLAMATION PLAN
FOR THE JONAH II FIELD
NATURAL GAS DEVELOPMENT PROJECT

Prepared for

Pinedale Resource Area
and
Green River Resource Area
Rock Springs District
Bureau of Land Management
Rock Springs, Wyoming

By

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 11434

May 1997

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LIST OF TABLES

B.1.0 RECLAMATION OBJECTIVES

This reclamation plan would be used by the Operators of the Jonah II Field Natural Gas Development Project as guidance to achieve successful reclamation on federal lands within the Jonah Field II Project Area (J2PA). Alternate reclamation procedures may be implemented on private and state lands. The plan complies with Bureau of Land Management (BLM) reclamation policy (BLM 1990c) and management directives specified in the Pinedale Resource Area Management Plan (BLM 1987a, 1987b). The reclamation plan was developed based on these policies and directives, Executive Order 11987, and impacts and scoping issues identified in the Jonah Field II environmental impact statement (EIS). The procedures presented in this plan are designed to allow flexibility based on specific conditions encountered at each proposed disturbance site. Site-specific reclamation procedures would be developed in each Application for Permit to Drill (APD), Right-of-way (ROW) application, or Sundry Notice and submitted to the BLM for review and approval prior to the authorization of surface-disturbing activities.

Short-term reclamation goals would be the immediate stabilization of disturbed areas and the protection of adjacent undisturbed areas from unnecessary degradation. The long-term reclamation objective would be to restore all disturbed lands to allow for the reestablishment of self-sustaining native vegetation. Other goals include the protection of surface water and groundwater resources through the reconstruction of a geologically and hydrologically stable landform that would support future land uses (i.e., wildlife habitat, recreation, livestock grazing, and mineral exploration).

BLM-required reclamation objectives are:

- the isolation and/or removal of all undesirable materials (e.g., poor quality subsoils, contaminated soils, potentially hazardous materials) to protect the reclaimed landscape from contamination;
- recontouring and implementation of other soil conservation, surface manipulation, and water management techniques to establish stable slopes, water courses, and drainage features to minimize erosion and sedimentation;
- revegetation of reclaimed areas to stabilize soils and establish a self-perpetuating native plant community capable of supporting post-disturbance land uses;
- establishment of acceptable long-term visual aesthetics by minimizing visual contrasts; and
- monitoring and management of reclamation sites by Operators to evaluate and encourage continued reclamation success (BLM 1990c).

The reclamation process has been divided into four major phases: predisturbance planning and site preparation, interim reclamation, permanent reclamation, and reclamation success monitoring. By minimizing the amount of land disturbed through predisturbance planning and initially preparing the site for construction activities with the understanding that the area would eventually be reclaimed (e.g., top soil stripping and stockpiling for later use during site reconstruction, keeping facilities away from cut-and-fill slopes and in as small an area as possible), the acreage requiring disturbance would be reduced and reclamation success would be facilitated.

Interim reclamation involves the reconstruction of areas during the planned development but not necessarily disturbed for the life-of-project (LOP) (production reclamation), as well as stabilization of disturbed areas to control runoff and erosion until permanent reclamation procedures are applied (temporary reclamation). Construction-related disturbance areas along road ROWs and topsoil stockpiles are examples of interim reclamation sites.

Permanent reclamation includes the reconstruction of locations no longer needed for the project. A nonproducing well location and associated access road are examples of permanent reclamation sites. Upon project completion, all disturbed areas except roads to be retained for other land uses would be reclaimed permanently as designated by the BLM or other landowner.

Reclamation success monitoring involves assessing the status of reclaimed areas to ensure they meet desired site stability and productivity standards.

B.2.0 AFFECTED COMMUNITIES

As described in Section 3.3.1 of this EIS, the J2PA is dominated by the Wyoming big sagebrush/grassland vegetation type. Saltbush and cushion plant communities also are present to a limited extent, primarily in the eastern portions of the J2PA.

Less than <1% of the J2PA is considered potential wetland. Potential wetlands occur primarily as inclusions within the dominant vegetation types and consist of ephemeral stream channels with ponds and reservoirs/impoundments adjacent to these channels. One additional potential wetland occurs as a 25-acre playa. Stabilized sand dunes also occur sporadically throughout the southern portions of the J2PA and occupy <1% of the area (see Section 3.2.3 and Map 3.1 in the EIS). No active dunes are known to occur.

Reclamation potential within the sagebrush, grassland, and potential wetland communities would be good to excellent; however, in the saltbush, cushion plant, and playa communities, reclamation would be limited by shallow soils, droughtiness, salinity, and other adverse soil characteristics. Sandy soils associated with stabilized dunes are very susceptible to wind erosion when vegetation cover is removed, and the reclamation of these areas following disturbance may pose the greatest challenge on the J2PA. Reclamation potential also may be limited by other extant conditions on the J2PA, including salinity, alkalinity, steep slopes, noncohesive soils, weather conditions (high winds, drought), periodic flooding, short growing seasons, and livestock and wildlife use.

B.3.0 PREDISTURBANCE PLANNING AND SITE PREPARATION

During selection of drill site, road, pipeline, and ancillary facility locations, consideration of future reclamation needs would facilitate land reclamation by minimizing the amount of land disturbed and avoiding, where practical , areas where reclamation potential is low. These avoidance areas include:

- areas with high erosion potential (e.g., rugged topography, steep slopes [>25%], stabilized sand dunes, floodplains);
- areas with saturated soils;
- wetland/riparian areas (e.g., perennial stream channels and open water areas) and a 500-ft buffer; and
- ephemeral and intermittent channels and a 100-ft buffer.

Prior to disturbance, Operators and the BLM would conduct on-site inspections of each proposed disturbance site to determine the suitability of proposed facility locations and/or alignments, and to develop a site-specific reclamation plan. In addition, Operators would submit for BLM approval Surface Use Plans and/or Plans of Development (PODs) for each proposed surface disturbance site. These plans would contain site-specific erosion control, revegetation, restoration, and monitoring procedures, and would provide information on the following:

- project administration, time frames, and responsible parties;
- reclamation objectives;
- topsoil removal, storage, and handling criteria;
- runoff, erosion, and sedimentation control procedures;
- seedbed preparation and seeding application procedures; and
- fertilization, mulching, and/or other site protection requirements (i.e., small-scale fencing and weed, livestock, and herbivore control).

Stormwater pollution prevention plans would be prepared for all project activities requiring greater than 5 acres of disturbance to ensure that precipitation would not cause erosion or sedimentation problems. These plans may be prepared for groups of wells, where multiple well, road, pipeline, and/or ancillary facility locations have been determined. A Notice of Intent would be submitted to the Wyoming Department of Environmental Quality for review, and a pollution prevention plan prepared and implemented. Copies of the pollution prevention plan and inspection reports would be retained on file in the Operators' offices.

B.3.1 TOPSOIL AND SUBSOIL HANDLING

Topsoil would be salvaged and stockpiled from all proposed disturbance areas unless the BLM deems that leaving topsoil in place (e.g., during pipeline construction) would better facilitate successful reclamation. Prior to BLM authorization of surface disturbance, the amount of topsoil or other suitable plant growth material to be removed and topsoil storage areas would be specified. If less than 6 inches of topsoil (i.e., soils with some organic matter content) are available, topsoils may be mixed with suitable subsoil materials for stockpiling so that a minimum of 6 inches of plant growth material is available for use during reclamation. Under no circumstances would subsoils that are unsuitable as a plant growth medium be mixed with topsoil materials. Decisions regarding the volume of topsoil removed and the need for mixing would be made on a site-specific basis during APD and ROW application processing. The need to strip topsoil for some project activities (e.g., along pipeline routes) also would be determined on a site-specific basis. Topsoil in excess of 6 inches, if available, may be stored for use in areas off-site that lack sufficient topsoil for reclamation. Whenever possible, topsoil would be used immediately. Topsoil stockpiled for more than 2 years would be protected from erosion by reducing piles to less than 3 ft in height and by seeding and possibly mulching (see Section B.4.0).

Topsoil stockpile areas would be marked in the field and noted on maps, and their surface area would be maximized to reduce adverse impacts to soil microorganisms. All surface vegetation stripped with topsoils would be incorporated directly into the topsoil to augment organic matter content and seed source availability, unless shrub materials are required to be handled separately. Runoff would be diverted around topsoil stockpiles to minimize erosional loss, and stockpiles would be located as close as possible to future reclamation sites.

Whenever possible, disturbance sites would be designed with a balance of cut and fill to minimize the

volume of subsoil stockpiled. When subsoil materials would be stockpiled, they would be isolated from topsoil stockpiles and located so as not to affect existing drainages. These stockpiles would be kept as small as possible and would be constructed to remain stable until they are used during reclamation. In addition, they would be located to minimize construction activity during recontouring.

In most instances, vegetation present at and surrounding proposed disturbance sites would provide sufficient information for determining reclamation seed mixes. Soil testing and reporting would be the responsibility of the Operators. Testing may include, but is not necessarily limited to pH; texture; salinity; alkalinity; nitrogen, phosphorus, and potassium levels; organic matter; and toxic elements (e.g., selenium).

Alternate site preparation procedures may be applied in some areas (i.e., dry alkaline sites, potential wetland areas) to facilitate reclamation; however, it is assumed that most, if not all, of these areas on the J2PA can be avoided. In dry alkaline areas (which generally occur at relatively flat sites associated with playas or broad drainages), there is often very little topsoil, and excavations may result in drainage problems. Vegetation and topsoil removal usually results in the need to import materials from off-site to build up required surfaces. Borrow material sources and quantities would be defined prior to construction.

In potential wetland areas, vegetation would be cut to ground level, leaving existing root systems intact. Grading activities would be limited to areas directly over pipeline trenches and road surface areas, and at least 12 inches of topsoil would be salvaged and replaced except in areas with standing water or saturated soils. Construction when the ground is frozen may be implemented as an alternative to minimize damage to wetland areas. Use of construction equipment would be limited, and if standing water or saturated soils are present, wide-track or balloon-tire construction equipment or normal construction equipment operated on equipment pads or geotextile fabric overlain with gravel fill may be used. Equipment pads would be removed immediately following completion of construction activities. Trench spoil would be placed at least 10 ft from drainage channel banks, and dirt, rockfill, and brush riprap would not be used to stabilize ROWs.

B.3.2 WELLPAD AND FACILITY SITE CONSTRUCTION

Prior to construction, proposed pad and facility site locations would be surveyed and staked, and the BLM would review all erosion control design considerations to determine their adequacy. Locations would be designed to parallel the contour with reserve pits on the uphill side of pads whenever possible. Wellpads would be designed and constructed to disturb the smallest area necessary to provide for efficient and safe operations.

All cut-and-fill slopes with greater than 3 ft cut and/or fill would be staked at least every 50 ft. Spoil storage areas would also be staked, and excess material would be incorporated into fill slopes or placed in designated areas and stabilized. Backsloping would be necessary only in areas of steep terrain (>10% slopes).

During construction, interceptor ditches would be installed above cuts and around reserve pits, as necessary. Collector ditches and sediment control structures designed for a 10-year/24-hr storm event may be required below fill areas. Flows of less than the 10-year/24-hr event would be diverted and/or collected before being discharged from the disturbed area. Qualified specialists would supervise the installation of all erosion control structures, including berms, dikes, and trenches.

B.3.3 ROADS

New roads generally would follow natural contours and would be constructed in accordance with BLM road standards (BLM 1985, 1991a). For roads on slopes of less than 15%, available topsoil would be stripped from the construction area and placed in windrows within the construction ROW by sidecasting with a grader. Where roads must be constructed on slopes greater than 15%, topsoil would be transported to more level terrain for storage. After road construction (first fall season during interim or permanent reclamation), topsoil would be replaced on road outslopes, and these areas would be reseeded (see Sections B.4.0 and B.5.0).

Surface runoff and control would be incorporated into all road designs in accordance with BLM standards (BLM 1985, 1991a), and would be approved by the BLM. Road grades, ditches, culverts, sediment traps,

material cuts and fills, and topsoil and spoil storage areas would be designed and located in the field prior to construction. Road culvert locations and spacings would be approved by the BLM prior to construction and would be in accordance with accepted engineering standards.

B.3.4 PIPELINES

When constructing and reclaiming pipelines, existing crowned-and-ditched roads would be used for access, where practical, to minimize surface disturbance. Pipeline trenches would not be placed in access road borrow ditches unless other reasonable locations were unavailable. Gathering pipelines may be installed on the surface in areas where slopes are greater than 25% and/or where rock outcrops are crossed; when possible, they would be built perpendicular to the contour to minimize the area required for construction.

Vegetation would be removed from pipeline ROWs so as to leave the root systems intact, and the removed vegetation would be spread over disturbed areas to provide protection, nutrient recycling, and a natural seed source. Pipeline trenches would be excavated with a backhoe to minimize disturbance.

Frozen soils, vegetation, and snow would not be used to backfill pipeline trenches. This action would reduce trench compaction needs. In no event would backfill berms in excess of 3 inches in height be placed over backfilled trenches.

Clean gravel would be used for the upper 1 ft of fill over backfilled pipeline trenches in perennial and intermittent streams. Silt fences or other sediment filtering devices would also be installed along channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetland/riparian areas. Trench plugs would be employed during pipeline construction at nonflumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches. Application of riprap would be limited to areas where flow conditions prevent vegetative stabilization. Riprap placement and installation would comply with COE permit requirements. Pipeline trenches would be dewatered so no silt-laden water flows into drainage channels. Where vegetation is disturbed, temporary sediment barriers such as silt fences and/or staked weed-free straw bales would be installed along the topographic contour at the base of slopes adjacent to the ROW crossing. Temporary sediment barriers would remain in place until permanent revegetation measures have been judged successful by the BLM.

B.4.0 INTERIM RECLAMATION

Interim reclamation would occur on all areas where permanent reclamation is not promptly applied and on areas that may be disturbed during final reclamation. Disturbed areas subject to interim reclamation include road cut-and-fill areas and portions of each wellpad and ancillary facility site not needed for production-related activities (production reclamation), and topsoil and subsoil stockpiles (temporary reclamation). Interim reclamation measures would be applied only as needed, since permanent reclamation measures would be applied concurrently with the completion of most project construction activities (i.e., permanent reclamation measures would be applied on all areas that would likely remain undisturbed for the remainder of the LOP) (see Section B.5.0).

Interim reclamation objectives include:

- stabilization of disturbed areas by providing wind and water erosion control to reduce soil loss and the chance of slope failure;
- minimization of surface runoff to prevent the degradation of downstream receiving waters through the use of pollution control techniques (e.g., facility sites would be required to approach zero runoff from the location, using interception ditches, berms, or other structures to capture accidental spills);
- establishment of nonintrusive plant communities to protect soil resources; and
- minimization of visual impacts.

Upon completion of a specific development activity (e.g., road construction, well testing), the area to be reclaimed for the LOP would be delineated. For example, all road topsoil storage in outslope areas, as well as the potentially disturbed outer portions of road ROWs, would be stabilized and reseeded until permanent road reclamation is initiated. Permanent reclamation practices (see Section B.5.0) would be applied on areas that would likely remain undisturbed for the remainder of the LOP.

Disturbed areas would be graded and contoured to slopes of 3:1 (horizontal:vertical) or less, as required to stabilize the area and provide a suitable seedbed. Contoured areas would be ripped, as necessary, to reduce soil compaction. Ripping in many areas may be conducted after topsoil replacement. Temporary erosion control measures (e.g., waterbars, mulch application, biodegradable netting installation) also would be applied as necessary. To minimize sedimentation of drainage channels and wetlands during the interim period between construction activity and final reclamation, temporary erosion and sediment control measures would be applied. Silt fences or other sediment filtering devices such as weed-free straw bales would be installed at drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetland/riparian areas. Sediment filtering devices would be cleaned out and maintained in functional condition throughout the LOP. To avoid the possibility of mulching materials entering waterways, loose mulch (i.e., mulch not crimped into the soil surface, tackified, or incorporated into erosion control blankets) would not be applied to drainage channel banks.

Seedbed preparation activities would include topsoil replacement and harrowing, discing, pitting, and/or ripping. After topsoil replacement and preparation, the area would be seeded at the first appropriate opportunity using a temporary seed mixture developed to facilitate the rapid establishment of vegetation (Table B.4.1) or a seed mixture designed for permanent reclamation (see Section B.5.0), as appropriate. Areas that have been seeded would be visually monitored for seedling establishment and the presence of erosional features, and would be restabilized and reseeded, as necessary, until adequate vegetation establishment and site stability is achieved (see Section B.6.0). In general, the permanent reclamation and success monitoring procedures specified in Sections B.5.0 and B.6.0 also would be applied at interim reclamation sites.

Table B.4.1 Temporary Reclamation Seed Mixture and Approximate Seeding Rates.[1]

Species	Approximate Seeding Rate (PLS/ac)[2]
Western wheatgrass (*Elymus smithii*)	2.0
Slender wheatgrass (*Elymus trachycaulum*)	2.0
Streambank wheatgrass (*Elymus riparium*)	2.0
Winter wheat (*Triticum aestivum*)[3]	10.0
Total	16.0

1 Alternative species may be reseeded in areas where permanent reclamation may be warranted and/or where the establishment of proposed species is repeatedly deemed unsuccessful. It is anticipated that this seed mixture primarily would be used on topsoil and subsoil stockpiles designated for long-term storage.

2 PLS/ac = pounds of pure live seed per acre; alternate seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plans of Development.

3 A sterile hybrid would be seeded as a cover crop; cover crops would be used only in areas where rapid site stabilization is desired and where further reseeding efforts likely would be conducted.

B.5.0 PERMANENT RECLAMATION

Disturbed areas would be reclaimed permanently as soon as practical, but within 2 years of the determination that these areas are no longer required for the project. Permanent reclamation objectives include all those listed for interim reclamation (see Section B.4.0), plus the following:

- the reestablishment of self-sustaining native vegetation communities that meet or exceed predisturbance parameters for cover, production, and diversity, as measured at adjacent undisturbed areas;
- the development of hydrologically stable landforms that meet future land uses including livestock grazing, wildlife habitat, recreation, and mineral exploration; and
- the restoration of the visual quality of the area such that it approximates the visual quality of adjacent undisturbed areas in line, form, color, and texture.

B.5.1 FACILITY AND STRUCTURE REMOVAL

All gas and water wells would be abandoned according to BLM and/or Wyoming Oil and Gas Conservation Commission regulations. All aboveground wellpad, pipeline, and water disposal facilities, including buildings, structures, tanks, reserve pits, flare pits, evaporation pits, and associated hardware, would be dismantled and removed from the site. These materials would be removed from BLM lands and likely would be salvaged and re-used or disposed of at approved sites.

Any liquid or solid wastes remaining at well locations would be tested and properly disposed of according to state and federal regulations. Reserve or evaporation pit liners would be disposed of according to BLM recommendations by removal to state-approved sites or by appropriate on-site burial. Any concrete foundations, pads, or footings would be adequately broken up and covered or removed. All aggregate used for wellpad, road, and/or ancillary facility site construction also would be removed or suitably buried.

Road reclamation would be conducted as deemed appropriate by the BLM; some roads may remain after project completion. Road reclamation would include the removal of bridges, culverts, cattleguards, sediment control structures, and signs. Drainage-crossing sideslopes would be reduced to no more than 4:1 to reduce bank erosion and produce stable sideslopes. In addition, road barriers or signs to discourage travel on the reclaimed road surface may be required by the BLM.

B.5.2 SURFACE PREPARATION

Surface preparation includes backfilling, grading, and ripping of compacted soils. In some areas subjected to interim reclamation (see Section B.4.0), topsoil removal and short-term storage may also be required.

B.5.2.1 Backfilling and Grading

After facilities and equipment have been removed, all disturbed areas would be recontoured by placing fill material back into cut areas to approximate original contours. Cut-and-fill slopes would be reduced to approximate original contours. Grading would provide a surface suitable for the replacement of a uniform depth of topsoil, while promoting cohesion between subsoil and topsoil layers, reducing wind erosion, and facilitating moisture capture.

Specialized grading techniques would be applied as necessary and may include slope rounding, bench grading, stair-step grading, and/or contour furrowing. Generally, these processes are accomplished either with scrapers or motor graders. Equipment selection would be determined on a site-specific basis dependent on the material to be graded, the size of the area, on-site operating conditions, and equipment availability.

Areas generally requiring backfilling include reserve pits, evaporation pits, pipeline trenches, and cut-and-fill areas. No visible soil berm (i.e., in excess of 3 inches) would be allowed above pipeline trenches. Operator-provided reclamation specialists would ensure that backfilling and grading operations are conducted so as to provide a landscape suitable for successful reclamation.

B.5.2.2 Ripping

Compacted areas such as roads and wellpads would be ripped to a minimum depth of approximately 2 ft to improve soil aeration, water infiltration, and root penetration. Ripper shanks would be set

approximately 2 ft apart. Waterbars and erosion control devices would be installed on reclaimed areas prior to topsoil replacement, as necessary, to control topsoil erosion (see Section B.5.5).

B.5.3 SEEDBED PREPARATION

Seedbed preparation maximizes seeding efficiency and improves reclamation success. It includes topsoil replacement (with amendments, where appropriate) and discing. Surface roughening procedures (e.g., pitting, gouging) also may be applied in some locations.

B.5.3.1 Topsoil Replacement

All topsoil salvaged during construction would be redistributed uniformly on the area to be reclaimed to depths of at least 6 inches, or more (up to 12 inches), if readily available, using a scraper or dozer, as appropriate for the material and site. Topsoil replacement would be scheduled immediately prior to seeding to maximize the potential for seedling establishment. Topsoil may require inoculation with soil microorganisms or fertilization at some locations to facilitate plant establishment and growth. Since precipitation in the J2PA is low, fertilizers generally would not be applied. Fertilizers would not be utilized proximal to open waters.

B.5.3.2 Discing

After topsoil replacement, newly topsoiled areas would be disced, harrowed, or ripped to reduce soil compaction, break up soil clods, improve root and water penetration, and provide a friable but firm seedbed. The Operator-provided reclamation specialist would determine how discing or harrowing would be accomplished. Generally, discing would be accomplished using a tractor-drawn implement set 2-6 inches deep.

B.5.4 REVEGETATION PRACTICES

B.5.4.1 Seeding

Reclaimed areas would be seeded using specific native species and seeding rates for the various soil and vegetation types present on the J2PA (Tables B.5.1-B.5.5). All seeds utilized for this project must be certified weed-free. The proposed seed mixes were developed based on the following criteria: general conditions within the analysis area; species adaptations to site conditions; usefulness of the species for rapid site stabilization; species success in past revegetation efforts; seed costs and availability; and compliance with Executive Order 11987 and BLM Manual Section 1745 (i.e., use of native species only). Certain introduced species have been used successfully for reclamation in the region; these species may have utility in site stabilization and revegetation where revegetation efforts with native species repeatedly have been unsuccessful. Operators would consult with the BLM and acquire BLM approval prior to the use of introduced species. Seed mixtures applied during revegetation would be designed in coordination with the BLM during the APD and ROW application approval processes.

Final determination of the appropriate seed mixture would be developed on a site-specific basis in coordination with the BLM at the time of field review (APD and ROW application review). Selected seeds may be inoculated with soil microorganisms to facilitate germination and growth. Soil and watershed protection would be emphasized when reclaiming disturbed areas. Reclaimed areas not exhibiting successful revegetation, as determined during monitoring (see Section B.6.0) would be reseeded and/or improved with soil amendments as deemed necessary by the BLM until adequate vegetative cover is established.

Seeding generally would be done in the fall between September 16 and freeze-up; however, some areas may be seeded in the early spring between spring thaw and May 15. Wherever possible, seed planting would be done along the contour using a rangeland drill equipped with an agitator and depth bands to mix seed and ensure proper seeding depths. Seeds would be planted 0.25 to 1.50 inches deep; most seeds would be planted 0.25 inches deep. When drill seeding is not practical due to steep slopes or wet soil conditions, broadcast seeding would be employed, seeding rates would be doubled, and the area would be raked or chained to cover seeds. To facilitate seed establishment, broadcast seeding may be used for shrub and forb species, utilizing either hand or specialized broadcast seeders; fluffy seeds (e.g., winterfat) may be broadcast simultaneously with drilled seeds. In addition, at sites where rapid shrub and/or tree establishment is desirable, bare-rooted or containerized stock may be hand-planted. Depending on site-specific circumstances, broadcast seeding may

Table B.5.1 Permanent Reclamation Species List for Sagebrush-dominated Communities with Sandy Soils.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Thickspike wheatgrass (*Elymus dasystachyum*)	2.00
Western wheatgrass (*Elymus smithii*)	2.00
Bluebunch wheatgrass (*Elymus spicatum*)	2.00
Indian ricegrass (*Oryzopsis hymenoides*)	3.00
Needle-and-thread (*Stipa comata*)	3.00
Forbs[3]	
Desert Indian paintbrush (*Castilleja chromosa*)	1.00
Scarlet globemallow (*Sphaeralcea coccinea*)	1.00
Shrubs[3]	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Common winterfat (*Krascheninnikovia lanata*)	1.00
Four-wing saltbush (*Atriplex canescens*)	3.00
Antelope bitterbrush (*Purshia tridentata*)	1.00

1 This seed mix may be modified based on site-specific conditions, the identification of additional useful species for rapid site stabilization, species success in past revegetation efforts, and seed availability and cost.

2 PLS/acre = pounds of pure live seed per acre; alternative seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plan of Development.

3 It is unlikely that all the forb and shrub species shown would be used at any one time.

Table B.5.2 Permanent Reclamation Species List for Sagebrush-dominated Communities with Alkaline Soils.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Western wheatgrass (*Elymus smithii*)	3.00
Thickspike wheatgrass (*Elymus dasystachyum*)	3.00
Alkaligrass (*Puccinellia distans*)	3.00
Alkali sacaton (*Sporobolus airoides*)	3.00
Forbs[3]	
Scarlet globemallow (*Sphaeralcea coccinea*)	1.00
Evening primrose (*Oenothera* sp.)	1.00
Shrubs[3]	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Common winterfat (*Kraschenninikovia lanata*)	1.00
Four-wing saltbush (*Atriplex canescens*)	3.00
Gardner saltbush (*Atriplex gardneri*)	1.00

1 This seed mix may be modified based on site-specific conditions, the identification of additional useful species for rapid site stabilization, species success in past revegetation efforts, and seed availability and cost.

2 PLS/acre = pounds of pure live seed per acre; alternative seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plans of Development.

3 It is unlikely that all the forb and shrub species shown would be used at any one time.

Table B.5.3 Permanent Reclamation Species List for Saltbush Communities.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Sandberg bluegrass (*Poa sandbergii*)	1.0
Western wheatgrass (*Elymus smithii*)	2.0
Thickspike wheatgrass (*Elymus dasystachyum*)	2.0
Alkaligrass (*Puccinellia distans*)	3.0
Alkali sacaton (*Sporobolus airoides*)	3.0
Forbs[3]	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.0
Northern sweetvetch (*Hedysarum boreale*)	1.0
Evening primrose (*Oenothera* sp.)	1.0
Shrubs[3]	
Four-wing saltbush (*Atriplex canescens*)	3.0
Shadscale (*Atriplex confertifolia*)	1.0
Gardner saltbush (*Atriplex gardneri*)	1.0
Common winterfat (*Krascheninnikovia lanata*)	1.0

1 This seed mix may be modified based on site-specific conditions, the identification of additional useful species for rapid site stabilization, species success in past revegetation efforts, and seed availability and cost.

2 PLS/acre = pounds of pure live seed per acre; alternative seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plans of Development.

3 It is unlikely that all the forb and shrub species shown would be used at any one time.

Table B.5.4 Permanent Reclamation Species List for Playas and other Alkaline Areas.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Muhly (*Muhlenbergia* spp.)	2.0
Alkaligrass (*Puccinellia distans*)	3.0
Alkali sacaton (*Sporobolus airoides*)	3.0
Western wheatgrass (*Elymus smithii*)	3.0
Forbs[3]	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.0
Northern sweetvetch (*Hedysarum boreale*)	2.0
Shrubs[3]	
Four-wing saltbush (*Atriplex canescens*)	3.0
Gardner saltbush (*Atriplex gardneri*)	1.0

1 This seed mix may be modified based on site-specific conditions, the identification of additional useful species for rapid site stabilization, species success in past revegetation efforts, and seed availability and cost.
2 PLS/acre = pounds of pure live seed per acre; alternative seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plans of Development.
3 It is unlikely that all the forb and shrub species shown would be used at any one time.

Table B.5.5 Permanent Reclamation Species List for Stabilized Sand Dune Communities.[1]

Species	Approximate Seeding Rate (PLS/acre)[2]
Grasses	
Prairie sandreed (*Calamovilfa longifolia*)	3.00
Bluebunch wheatgrass (*Elymus spicatum*)	2.00
Sand dropseed (*Sporobolus cryptandrus*)	2.00
Indian ricegrass (*Oryzopsis hymenoides*)	2.00
Needle-and-thread (*Stipa comata*)	2.00
Basin wildrye (*Elymus cinerus*)	1.00
Forbs[3]	
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	1.00
Desert Indian paintbrush (*Castilleja chromosa*)	1.00
Northern sweetvetch (*Hedysarum boreale*)	1.00
Shrubs[3]	
Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)	0.25
Spiny hopsage (*Grayia spinosa*)	1.00

1 This seed mix may be modified based on site-specific conditions, the identification of additional useful species for rapid site stabilization, species success in past revegetation efforts, and seed availability and cost.

2 PLS/acre = pounds of pure live seed per acre; alternative seeding rates may be applied in some areas as deemed appropriate by the BLM and specified in approved Surface Use Plans and/or Plans of Development.

3 It is unlikely that all the forb and shrub species shown would be used at any one time.

be accomplished following mulch and crimping operations.

B.5.4.2 Mulching

Immediately following seeding, selected areas with a high erosion potential (e.g., steeply sloped areas along roads and/or pipelines, sandy soil areas) would be uniformly mulched (75% minimum cover) with native grass, hay, small grain straw, wood fiber, and/or live mulch, at a rate of approximately 1-2 tons/acre. Cotton, jute, or synthetic netting also may be applied at some sites. Only certified weed-free mulches would be used, thereby minimizing the potential for noxious weed introduction. Mulch would be crimped in place using a serrated disc crimper or similar implement. Mulch protects the soil from wind and water erosion, raindrop impact, and surface runoff and holds seeds in place. On slopes of greater than 30% or exceeding the operating limits of the equipment, or sites containing 35% surface rock content, sandy soil areas, or other unstable areas, hydromulch, biodegradable erosion control netting, rock mulch, or matting attached firmly to the soil surface would be applied, as necessary.

B.5.5 SEDIMENTATION AND EROSION CONTROL DEVICES

Erosion and sediment control measures and structures would be installed, as appropriate, on all reclaimed areas. The type of control measure used would depend on slope gradient and the susceptibility of disturbed soils to wind and water erosion. Runoff control along linear disturbances such as roads and pipelines would be accomplished using standard measures including, but not limited to, waterbars, silt fences, energy dissipators, mulches, and cross ditches. Waterbars would be installed in accordance with standard BLM specifications and would begin and end in undisturbed vegetation. Waterbars generally would be 12-18 inches deep, have a 2% grade, and be sloped such that disturbed areas are crossed only once and water is not discharged onto disturbed areas. Silt fences would be placed at the base of all steep fill slopes. Instream protection devices (e.g., drop structures) also may be required to prevent erosion in drainages crossed by pipelines. Information on the techniques to be implemented, as determined based on site-specific conditions and associated BLM interdisciplinary team requirements, would be included in APDs, ROW applications, Sundry Notice Surface Use Plans, and/or PODs.

Additional runoff and erosion control along ROWs would be accomplished by implementing standard cross drain, culvert, road ditch, and turnout design, as well as timely stabilization and revegetation of exposed areas. Culvert entrances and exits would be riprapped or protected with energy dissipators or other scour-reducing techniques, as needed, and where appropriate. Water discharged from culverts, cross drains, road ditches, and turnouts would be directed appropriately either into undisturbed vegetation or natural drainages. Erosion and sedimentation control measures and structures, as approved by the BLM, would be installed across all cut-and-fill slopes within 100 ft of drainage channels. All runoff and erosion control structures would be inspected by the Operators annually and after major runoff events and would be maintained (e.g., cleaned out) throughout the LOP.

B.6.0 RECLAMATION SUCCESS MONITORING

Reclamation success would be based on the objectives specified in this plan, and monitoring would occur annually or at shorter intervals until reclamation efforts are deemed successful by the BLM. Monitoring activities would evaluate the condition of reclamation efforts, determine the prognosis for reclamation success, and determine the need for remediation. Additional monitoring procedures for quantitative and qualitative evaluations of reclamation success may be implemented as specified in BLM-approved Surface Use Plans or PODs. Standard revegetation success criteria involve the attainment of 50% of predisturbance vegetation cover in 2 years and 60% cover in 5 years. Basal cover is used for grasses and forbs, and leaf cover is measured for shrubs.

The monitoring program presented herein is designed to provide an approach to reclamation monitoring on the J2PA and includes evaluations which would assist in making future land management decisions in the area. More specific objectives include:

- delineation of monitoring responsibilities;
- identification of reclamation success criteria; and
- specification of monitoring protocols.

Both interim and permanent reclamation success would be monitored. Interim reclamation monitoring would include visual observations of soil stability, effectiveness of erosion control practices, and qualitative evaluations of vegetation establishment and assessments of weed invasion. The Operators would be responsible for weed control on surface disturbance and reclamation sites. If chemical weed controls are deemed necessary, chemicals would be used only in the season or growth stage during which they are most effective, and would be applied only by certified personnel using approved precautions, application methods, and rates in compliance with all applicable federal, state, and local regulations. Use of herbicides would be avoided near open waters or during extremely windy conditions.

Permanent reclamation would be monitored visually for soil stability, particularly near wetland/riparian areas, open waters, or ephemeral stream channels. Mulch effectiveness and other erosion control devices would be assessed, and qualitative evaluations of vegetation establishment and success would be made. Quantitative measurements for vegetation success as measured by percent cover, production, shrub establishment, and/or measures of diversity would be implemented as specified by the BLM. If reclamation monitoring reveals that soil stability, weed abundance, or vegetation establishment/productivity do not meet required standards, additional treatments would be undertaken promptly by the Operators, in cooperation with the BLM. Continued efforts would be required until satisfactory vegetative cover and productivity are achieved and the site is adequately stabilized. Additional treatments could include, but are not limited to, installation of additional erosion control devices, fencing, herbicide or fertilizer application, reseeding, or remulching.

B.6.1 MONITORING RESPONSIBILITY

Reclamation monitoring would be the responsibility of the BLM and would be accomplished through joint, coordinated monitoring efforts. Monitoring would be conducted following initial reclamation work, and reexamination would occur at the end of the first growing season. Results would be reported on forms as presented in Addendum A. Problem areas identified during monitoring would receive follow-up reconstruction/erosion control measures. If required, the BLM would revisit monitoring sites during the second or third growing seasons, and sites would be reassessed using the same methodologies initially applied. If required, monitoring results would be provided to the Operators to show progress and call attention to additional stabilization/reclamation needs. Additional monitoring sites would be established, as necessary, by the BLM (in coordination with the Operator) for "long-term" monitoring on significant problem areas not covered by initial efforts.

Follow-up monitoring would be conducted periodically by the BLM until reclamation goals are attained (see Section B.6.3). Once reclamation goals are attained, no further formal monitoring would be conducted. It is expected that most monitoring sites would reveal adequate site reclamation within approximately 5 years; therefore, monitoring activities usually would be discontinued after 5 years. This would allow personnel to concentrate on monitoring installation and evaluation on "long-term" problem sites. Operators would be advised of reclamation status through joint review of monitoring sites.

Generally, reclamation success would be based on site-specific potential. Revegetation objectives and success criteria would be tailored to site potential. When the site has reached long-term stabilization and the composition of desired forage is consistent with objectives and criteria, the monitoring site would be abandoned. Monitoring data would be compiled by the BLM to provide future guidance for successful reclamation planning.

B.6.2 MONITORING PROTOCOL

The forms presented in Addendum A serve as guidelines for the collection of site-specific information, documentation of treatments, and a record for evaluation. Alternative forms may be used as deemed appropriate by the BLM.

The forms presented in Addendum A or other BLM-approved forms would be used for annual monitoring conducted by the BLM during the first growing season and during subsequent years and until reclamation is deemed successful. Data collection would take place during July, August, and September using point sampling transects on adjacent undisturbed areas of the same vegetation type, and if additional reclamation work is necessary, Operators would be required to conduct this work.

B.6.3 GENERAL SUCCESS CRITERIA

The following success criteria would be used to determine the attainment of adequate site reclamation and whether bond liability should be released. Additional success criteria (e.g., productivity, diversity, shrub establishment) would be included, as necessary, in site-specific Surface Use Plans and/or PODs and would be approved by the BLM prior to site disturbance.

B.6.3.1 General Criteria

- There would be no contaminated materials remaining at or near the surface, and all buried undesirable materials would be physically isolated for long-term stabilization.
- The subsurface would be stabilized, holes would be plugged, and subsurface integrity would be ensured. No indications of open or unplugged holes, subsidence, slumping, and/or significant downward movement of surface soil materials would be visible.
- The reclaimed area would be stable and would not exhibit rills or gullies (e.g., >2 inches wide/deep), perceptible soil movement or head cutting in drainage, and/or slope instability on or adjacent to the reclaimed area.
- The soil surface would be stable and have adequate surface roughness to reduce runoff and capture rainfall and snow melt.
- The vegetation would stabilize the site and support postdisturbance land uses, provide for natural plant community succession and development, and be capable of renewing itself. There would be evidence of successful on-site establishment of species included in the planting mixture or other desirable species and/or evidence of vegetation reproduction, either spreading by rhizomatous species or seed production.
- The reclaimed landscape would have characteristics that approximate the visual quality of the adjacent area with regard to location, scale (e.g., line, form, and texture), shape, color, and orientation of major landscape features and would meet the needs of the postdisturbance land uses.
- During and following reclamation activities, Operators would monitor and protect the reclaimed landscape to help ensure reclamation success until the liability and bond are released. Each of the previous six standards would be maintained until it can be determined that the reclamation effort was successful.
- With the exception of active work areas, all disturbed highly erosive or sensitive areas to be left bare or unreclaimed for more than three months would be covered by a protective layer of suitable material (e.g., mulch, matting, or vegetative growth). All other disturbed areas would be adequately protected within six months.

B.6.3.2 Second Year (Final Reclamation) Criteria

- Seeding density. The density and abundance of desirable species on reclaimed areas would be considered adequate where they approximate conditions found on off-site/undisturbed areas.

- Percent cover. Total grass and forb vegetative cover (basal) would be at least 50% of predisturbance cover as measured along the reference transect for establishing baseline conditions.

- Species diversity. At least 20% of the species contained in the seed mix and/or present on adjacent areas would be present, and no single species would account for more than 80% of the total vegetative cover.

- Undesirable species. Weeds or other undesirable species would comprise no more than 10% of the total vegetative cover. All noxious weeds would be controlled, as appropriate.

B.6.3.3 Fifth Year (Final Reclamation) Criteria

- Percent cover. Total vegetative cover (basal for grasses and forbs and foliar for shrubs) would be at least 60% of predisturbance cover as measured along the reference transect for establishing baseline conditions.

- Dominant species. Ninety percent of the revegetation would consist of species included in the seed mix and/or occurring in the surrounding natural vegetation, or as would be deemed desirable by the BLM as measured along the reference transect for establishing baseline conditions.

- Erosion condition/soil surface factor. Erosion condition of reclaimed areas would be equal to or in better condition than that measured for the reference transect for establishing baseline conditions.

B.7.0 REFERENCES

Bureau of Land Management. 1985. Manual 9113: Roads. Engineering, Rel. 9-247. U.S. Department of the Interior, Bureau of Land Management.

_____. 1987a. Pinedale Resource Area Draft Resource Management Plan/Environmental Impact Statement. Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming, and Pinedale Resource Area, Pinedale, Wyoming.

_____. 1987b. Pinedale Resource Area Final Management Plan/Environmental Impact Statement. Bureau of Land Management, Rock Springs District, Rock Springs, Wyoming, and Pinedale Resource Area, Pinedale, Wyoming.

_____. 1990c. Wyoming Policy on Reclamation. U.S. Department of the Interior, Bureau of Land Management, Rawlins District Office, Rawlins, Wyoming. February 2, 1990.

_____. 1991a. Wyoming Supplement to the Bureau 9113 Manual. U.S. Department of the Interior, Bureau of Land Management, Wyoming State Office, Cheyenne, Wyoming. 16 pp.

ADDENDUM B-A:
RECLAMATION MONITORING FORMS

(Alternative forms may be employed)

INSPECTION REPORTS, U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT
OIL AND GAS SURFACE INSPECTION FORM -- ACTIVE LOCATIONS **PRINTED: 91/12/20**

Inspector:______________ Date:____________ Sma:________________ Qtr/Qtr:______

Well Name:______________ Well No.:__________ Well Status:______________ Sect:________

Operator:______________ ROW Ref.:______________________________ Twn:________

Lease No.:______________ Representative:__________________________ Rng:________

Insp. Item I.D.:______________________________ Unique Well No.:__________ Insp. No.:______

STATUS: Construction:____________ Drilling:______________ Production:____________
Estimated Acres Disturbed:__________ Estimated Acres Reclaimed:______________

S/U/A:

______ **ROAD:** Earthwork:______________ Culverts/Drainage:________________
Surface Material:______________ Revegetation:________________
Remarks:____

______ **PAD:** Earthwork:______________ Culverts/Drainage:________________
Gen. Condition:______________ Revegetation:________________
Remarks:____

______ **PITS:** Type: Reserve:____________ Production:________________
Earthwork:______________ Fluid/Oil:________________
Pits: Lined:________ Unlined:________ Fenced:__________ Unfenced:__________
Remarks:____

______ **FACILITIES:** Well Sign:__________ Paint:________________
Production/Drilling Facility Layout (including dikes):________________
Pipeline:____________ Power Line:____________ As Approved:__________
Remarks:____

ACTION REQUIRED:
Verbal Follow-up:__________ Letter:______________ INC Written:__________
Notify P.E.T.:____________ Other:______________

Correct Problem By:________________ Next Inspection:________________
Inspection Hours:________________ Signature:________________

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT
OIL AND GAS SURFACE INSPECTION FORM -- ABANDONED LOCATIONS

PRINTED: 91/12/20

Inspector:__________ Date:__________ Sma:__________ Qtr/Qtr:______

Well Name:__________ Well No.:__________ Well Status:__________ Sect:______

Operator:__________ ROW Ref.:__________ Twn:______

Lease No.:__________ Representative:__________ Rng:______

Insp. Item I.D.:__________ Unique Well No.:__________ Insp. No.:______

STATUS: Construction:__________ Drilling:__________ Production:__________
Estimated Acres Disturbed:__________ Estimated Acres Reclaimed:__________

S/U/A:

______ **ROAD:** Recontoured:__________ Revegetation:__________ Erosion:__________
Remarks:__________

______ **PAD/PIT:** Recontoured:__________ Revegetation:__________ Erosion:__________
Remarks:__________

OTHER INFORMATION:

Dry Hole Marker:__________ Water Well Plugged:__________
Seeding Date:__________ Growing Season (1-99 years):__________
Seeding Method: Drill:__________ Broadcast:__________ Other:__________
Species Required:__________

Species Present:__________

Remarks:__________

SITE RECOMMENDATION:

Remedial Action Needed:__________ Reclamation Acceptable:__________
Remarks:__________

Correct Problem By:__________ Next Inspection:__________
Inspection Hours:__________ Signature:__________

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT
OIL AND GAS SURFACE INSPECTION FORM -- ABANDONED LOCATIONS

PRINTED: 91/12/20

VEGETATION CONDITION RATING:

Revegetation % Cover	Reference Vegetation % Cover
____% Bare Ground	____% Bare Ground
____% Plant	____% Plant
____% Litter	____% Litter
____% Rock	____% Rock
____% Total (Plant, Litter, and Rock)	____% Total (Plant, Litter, and Rock)

Predisturbance Rating:______________ (reveg. cond. total/refer. cond. total x 100)

APPENDIX C:

HAZARDOUS MATERIALS SUMMARY

HAZARDOUS MATERIALS SUMMARY FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT

Prepared for

Pinedale Resource Area
and
Green River Resource Area
Rock Springs District
Bureau of Land Management
Rock Springs, Wyoming

By

TRC Mariah Associates Inc.
Laramie, Wyoming
MAI Project 11434

May 1997

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C-1.0 INTRODUCTION

This Hazardous Materials Summary is provided pursuant to Bureau of Land Management (BLM) Instruction Memoranda Numbers WO-93-344 and WY-94-059, which require that all National Environmental Policy Act (NEPA) documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. The summary serves as a supplement to the Jonah Field II Natural Gas Development Project Environmental Impact Statement.

Materials are considered hazardous if they contain chemicals or substances listed in the Environmental Protection Agency's (EPA's) *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986*. Extremely hazardous materials are those identified in the EPA's *List of Extremely Hazardous Substances* (40 Code of Federal Regulations [CFR] 355).

Hazardous materials anticipated to be used or produced during the project may come from drilling materials, casing and plugging materials, fracturing materials, production products, fuels, geophysical survey materials, pipeline materials, emissions, and miscellaneous materials. Where possible, the quantities of these products or materials have been estimated on a per-well basis. Hazardous and extremely hazardous constituents potentially occurring in these products or materials have been identified and are listed in Table C-1.1.

C-1.1 DRILLING MATERIALS

Water-based drilling fluids consisting of clays and other additives would be utilized by drilling companies for drilling each well. Drilling fluid additives potentially containing hazardous materials are listed in Table C-1.1. The polyacrilamides used in drilling may contain the extremely hazardous substance acrylamide. Drilling fluid additives would be transported to well locations during drilling operations in appropriate sacks and containers. Drilling fluids, cuttings, and water would be stored in reserve pits located on-site, and reserve pits would be lined as directed by the BLM to conserve water and protect near-surface aquifers. When the reserve pit is no longer required, its contents would be evaporated or solidified in place and the pit backfilled as approved by the BLM.

C-1.2 CEMENTING AND PLUGGING MATERIALS

Well completion and abandonment operations include cementing and plugging various segments of the well bore to protect freshwater aquifers and other down-hole resources. Wells would be cased and cemented as approved by the BLM (for federal minerals) and Wyoming Oil and Gas Conservation Commission (WOGCC) (for state and patented minerals). Cementing and plugging materials potentially containing hazardous materials are listed in Table C-1.1. The extremely hazardous material acrylamide may be present in fluid loss additives. All casing and plugging materials would be transported in bulk to each well site. Small quantities may be transported and stored on-site in appropriate containers.

C-1.3 FRACTURING MATERIALS

Hydraulic fracturing is expected to be performed at all proposed wells to enhance gas flow rates. Fracturing fluids consist primarily of fresh water, but would contain some additives with hazardous constituents as shown in Table C-1.1. Fracturing materials would be transported to well locations in bulk or in manufacturer's containers. Waste fracturing fluids would be collected in aboveground tanks and/or reserve pits and evaporated, or hauled away from the location and reused at another well or disposed of at an authorized facility.

C-1.4 PRODUCTION PRODUCTS

C-1.4.1 Natural Gas

Natural gas produced from the exploratory wells primarily would contain methane, ethane, and carbon dioxide. Hexane, polycyclic aromatic hydrocarbons, and polycyclic organic matter are hazardous substances potentially present in the gas stream (Table C-1.1). No extremely hazardous materials are anticipated to be present. Small quantities of natural gas may be flared into a flare pit during well testing operations, pursuant to BLM/WOGCC rules and regulations (Notice to Lessees [NTL]-4A). BLM and

Table C-1.1 Hazardous and Extremely Hazardous Materials Potentially Utilized or Produced During Construction, Drilling, Production, and Reclamation Operations by the Jonah Field II Natural Gas Development Project, Sublette County, Wyoming, 1997.

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Drilling Materials				
Barite	16,000 lbs	Barium compounds		–
		Fine mineral fibers		–
Bentonite	45,000 lbs	Fine mineral fibers		–
Caustic soda	750 lbs	Sodium hydroxide		1310-73-2
Glutaraldehyde	20 gal	Isopropyl alcohol		67-63-0
Lime	3,500 lbs	Calcium hydroxide		1305-62-0
Mica	600 lbs	Fine mineral fibers		–
Modified tannin	250 lbs	Ferrous sulfate		7720-78-7
		Fine mineral fibers		–
Phosphate esters	100 gal	Methanol		67-56-1
Polyacrylamides	100 gal		Acrylamide	79-06-1
		PAHs[4]		–
		Petroleum distillates		64742-47-8
		POM[5]		–
Retarder	400 lbs	Fine mineral fibers		–
Cementing and Plugging Materials				
Anti-foamer	100 lbs	Glycol ethers		–
Calcium chloride flake	2,500 lbs	Fine mineral fibers		–
Cellophane flake	300 lbs	Fine mineral fibers		–
Cements	77,000 lbs	Aluminum oxide		1344-28-1
		Fine mineral fibers		–
Chemical wash	850 gal	Ammonium hydroxide		1336-21-6
		Glycol ethers		–
Diatomaceous earth	1,000 lbs	Fine mineral fibers		–
Extenders	17,500 lbs	Aluminum oxide		1344-28-1
		Fine mineral fibers		–
Fluid loss additive	900 lbs		Acrylamide	79-06-1
		Fine mineral fibers		–
		Napthalene		91-20-3
Friction reducer	160 lbs	Fine mineral fibers		–
		Napthalene		91-20-3
		PAHs		–
		POM		–
Mud flash	250 lbs	Fine mineral fibers		–
Retarder	100 lbs	Fine mineral fibers		–
Salt	2,570 lbs	Fine mineral fibers		–
Silica flour	4,800 lbs	Fine mineral fibers		–

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Fracturing Materials				
Biocides	6 gal	Fine mineral fibers		–
		PAHs		–
		POM		–
Breakers	145 lbs	Ammonium persulphate		7727-54-0
		Ammonium sulphate		7783-20-2
		Copper compounds		–
		Ethylene glycol		107-21-1
		Fine mineral fibers		–
		Glycol ethers		–
Clay stabilizer	50 gal	Fine mineral fibers		–
		Glycol ethers		–
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		–
		POM		–
Crosslinkers	60 gal	Ammonium chloride		12125-02-9
		Methanol		67-56-1
		Potassium hydroxide		1310-58-3
		Zirconium nitrate		13746-89-9
		Zirconium sulfate		14644-61-2
Foaming agent	120 gal	Glycol ethers		–
Gelling agent	950 gal	Benzene		71-43-2
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Napthalene		91-20-3
		PAHs		–
		POM		–
		Sodium hydroxide		1310-73-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
pH buffers	60 gal	Acetic acid		64-19-7
		Benzoic acid		65-85-0
		Fumaric acid		110-17-8
		Hydrochloric acid		7647-01-0
		Sodium hydroxide		1310-73-2
Sands	2,000,000 lbs	Fine mineral fibers		–
Solvents	50 gal	Glycol ethers		–
Surfactants	15 gal	Glycol ethers		–
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		–
		POM		–

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Production Products				
Liquid hydrocarbons	<5-45 bpd	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		–
		POM		–
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	0.5->5.0 mmcfd	n-Hexane		110-54-3
		PAHs		–
		POM		–
Produced water/cuttings	0.5-10 bpd water and an unknown quantity of cuttings	Arsenic		7440-38-2
		Barium		7440-39-3
		Cadmium		7440-43-9
		Chromium		7440-47-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Mercury		7439-97-6
		Radium 226		–
		Selenium		7782-49-2
		Uranium		–
		Other radionuclides		–
Fuels				
Diesel fuel	>36,300 gal	Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		–
		POM		–
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Gasoline	Unk	Benzene		71-43-2
		Cumene		98-82-8
		Cyclohexane		110-82-7
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		PAHs		–
		POM		–
			Tetraethyl lead	78-00-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	Unk	n-Hexane		110-54-3
		PAHs		–
		POM		–
Propane	Unk	Propylene		115-07-1

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Geophysical Survey Materials				
Explosives, fuses, detonators, boosters, fuels	Unk	Aluminum		7429-90-5
		Ammonium nitrate		6484-52-2
		Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Ethylene glycol		107-21-1
		Lead compounds		7439-92-1
		Methyl tert-butyl ether		1634-04-4
		Naphthalene		91-20-3
		Nitric acid		7697-37-2
		Nitroglycerine		55-63-0
		PAHs		–
		POM		–
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Pipeline Materials				
Coating	Unk	Aluminum oxide		1334-28-1
Cupric sulfate solution	Unk	Cupric sulfate		7758-98-7
		Sulfuric acid		7664-93-9
Diethanolamine	Unk	Diethanolamine		111-42-2
LP Gas	Unk	Benzene		71-43-2
		n-Hexane		110-54-3
		Propylene		115-07-1
Molecular sieves	Unk	Aluminum oxide		1344-28-1
Pipeline primer	Unk	Naphthalene		91-20-3
		Toluene		108-88-3
Potassium hydroxide solution	Unk	Potassium hydroxide		1310-58-3
Rubber resin coatings	Unk	Acetone		67-64-1
		Coal tar pitch		68187-57-5
		Ethyl acetate		141-78-6
		Methyl ethyl ketone		78-93-3
		Toluene		108-88-3
		Xylene		1330-20-7
Emissions				
Gases	127 tons[6]	Formaldehyde		50-00-0
			Nitrogen dioxide	10102-44-0
			Ozone	10028-15-6
			Sulfur dioxide	7446-09-5
			Sulfur trioxide	7446-11-9
Hydrocarbons	492 tons[7]	Benzene		71-43-2
		Ethylbenzene		100-41-4
		n-Hexane		100-54-3
		PAHs		–
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Particulate matter	24 tons[8]	Barium		7440-39-3
		Cadmium		7440-43-9
		Copper		7440-50-8
		Fine mineral fibers		--
		Lead		7439-92-1
		Manganese		7439-96-5
		Nickel		7440-02-0
		POM		--
		Zinc		7440-66-6
Miscellaneous Materials				
Acids	Unk	Acetic anhydride		108-24-7
		Formic acid		64-18-6
		Sodium chromate		777-11-3
		Sulfuric acid		7664-93-9
Antifreeze, heat control, and dehydration agents	300 gal	Acrolein		107-02-8
		Cupric sulfate		7758-38-7
		Ethylene glycol		107-21-1
		Freon		76-13-1
		Phosphoric acid		766-38-2
		Potassium hydroxide		1310-58-3
		Sodium hydroxide		1310-73-2
		Triethylene glycol		112-27-6
Batteries	Unk	Cadmium		7440-43-9
		Cadmium oxide		1306-19-0
		Lead		7439-92-1
		Nickel hydroxide		7440-02-0
		Potassium hydroxide		1310-58-3
		Sulfuric acid		7664-93-9
Biocides	Unk	Formaldehyde		50-00-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
Cleaners	Unk	Hydrochloric acid		7647-01-0
Corrosion inhibitors	Unk	4-4' methylene dianiline		101-77-9
		Acetic acid		64-19-7
		Ammonium bisulfite		10192-30-0
		Basic zinc carbonate		3486-35-9
		Diethylamine		109-89-7
		Dodecylbenzenesulfonic acid		27176-87-0
		Ethylene glycol		107-21-1
		Isobutyl alcohol		78-83-1
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Napthalene		91-20-3
		Sodium nitrite		7632-00-0
		Toluene		108-88-3
		Xylene		1330-20-7
Emulsion breakers	Unk	Acetic acid		64-19-7
		Acetone		67-64-1
		Ammonium chloride		12125-02-9
		Benzoic acid		65-85-0
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		Napthalene		91-20-3
		Toluene		108-88-3
		Xylene		1330-20-7
		Zinc chloride		7646-85-7

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Fertilizers	Unk	Unk		–
Herbicides	Unk	Unk		–
Lead-free thread compound	25 gal	Copper Zinc		7440-50-8 7440-66-6
Lubricants	Unk	1,2,4-trimethylbenzene Barium Cadmium Copper n-Hexane Lead Manganese Nickel PAHs POM Zinc		95-63-6 7440-39-3 7440-43-9 7440-50-8 110-54-3 7439-92-1 7439-96-5 7440-02-0 – – 7440-66-6
Methanol	200 gal	Methanol		67-56-1
Motor oil	220 gal	Zinc compounds		–
Paints	Unk	Aluminum Barium n-Butyl alcohol Cobalt Lead Manganese PAHs POM Sulfuric acid Toluene Triethylamine Xylene		7429-90-5 7440-39-3 71-36-3 7440-48-4 7439-92-1 7439-96-5 – – 7664-93-9 108-88-3 121-44-8 1330-20-7
Paraffin control	Unk	Carbon disulfide Ethylbenzene Methanol Toluene Xylene		75-15-0 100-41-4 67-56-1 108-88-3 1330-20-7
Photoreceptors	Unk	Selenium		7782-49-2
Scale inhibitors	Unk	Acetic acid Ethylene diamine tetra Ethylene glycol Formaldehyde Hydrochloric acid Isopropyl alcohol Methanol Nitrilotriacetic acid		64-19-7 60-00-4 107-21-1 50-00-0 7647-01-0 67-63-1 67-56-1 139-13-9
Sealants	Unk	1,1,1-trichloroethane n-Hexane PAHs POM		71-55-6 110-54-3 – –

Table C-1.1 (Continued)

Source	Approximate Quantities Used or Produced Per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Solvents	Unk	1,1,1-trichloroethane		71-55-6
		Acetone		67-64-1
		t-Butyl alcohol		75-65-0
		Carbontetrachloride		56-23-5
		Isopropyl alcohol		67-63-0
		Methyl ethyl ketone		108-10-1
		Methanol		67-56-1
		PAHs		–
		POM		–
		Toluene		108-88-3
		Xylene		1330-20-7
Starting fluid	Unk	Ethyl ether		60-29-7
Surfactants	Unk	Ethylene diamine		107-15-3
		Isopropyl alcohol		67-56-1
		Petroleum naphtha		8030-30-6

1 lbs = pounds; gal = gallons; bpd = barrels per day; mmcfd = million cubic feet per day; Unk = unknown quantities to be listed based on information availability

2 Hazardous substances are those constituents listed under the Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, as amended.

3 Extremely hazardous substances are those defined in 40 CFR 355.

4 PAHs = polynuclear aromatic hydrocarbons

5 POM = polycyclic organic matter

6 Value includes NO_x (107 tons per well) and SO^2 (20 tons per well) estimates only, as adapted from BLM (1996b).

7 Value includes volatile organic compound emission estimates only, as adapted from BLM (1996b).

8 Value includes PM_{10} emission estimates only, as adapted from BLM (1996b).

WOGCC approval would be necessary prior to flaring operations. No natural gas would be stored on site.

C-1.4.2 Liquid Hydrocarbons

Condensates and/or oil produced in association with the gas stream are expected from productive wells. Hazardous materials potentially present in the liquid hydrocarbons are listed in Table C-1.1. No extremely hazardous materials are known to be present in the liquid hydrocarbons.

Liquid hydrocarbons would be stored in tanks at well locations and all tanks would be fenced and bermed to contain 110% of the entire storage capacity of the largest tank. Liquid hydrocarbons periodically would be removed from storage tanks and transported by truck off the project area for sale to refineries. All necessary authorizing actions for the production, storage, and transport of liquid hydrocarbons, including the Oil Pollution Act of 1990, would be addressed prior to the initiation of production activities.

C-1.4.3 Water/Cuttings

Hazardous materials potentially present in trace amounts in produced water and drill cuttings are listed in Table C-1.1. No extremely hazardous materials are expected in the produced water or cuttings.

Produced water would be stored in tanks at well locations and periodically would be removed and transported to Wyoming Department of Environmental Quality (WDEQ)- or WOGCC-permitted water disposal facilities. Produced water quality from wells would be monitored periodically, and produced water that meets applicable standards would be discharged to the surface at appropriate locations. Necessary authorizing actions that must be met prior to the disposal of produced water include:

- BLM approval of disposal methodologies;
- Resource Conservation and Recovery Act compliance, as necessary;
- WDEQ Water Quality Division approval of wastewater disposal (e.g., National Pollution Discharge Elimination System permits);
- WOGCC evaporation pond permits; and
- Wyoming State Engineer's Office dewatering permits (Form U.W. 5).

Drill cuttings would be stored in reserve pits and, after evaporation, the pit would be backfilled as approved by the BLM.

C-1.5 FUELS

Diesel fuel, gasoline, natural gas, and propane would be used for the project. All contain hazardous materials (Table C-1.1). Gasoline and diesel would be used by vehicles providing transport to and from the project area. Diesel fuel also would be used in drilling operations, construction equipment, and as a minor component of fracturing fluids. Natural gas produced by the proposed project would be used to power pipeline compressor stations and other ancillary facilities. Propane would be utilized for miscellaneous heating purposes.

C-1.5.1 Gasoline

Gasoline is known to contain hazardous materials. Gasoline for this project would be purchased from regional vendors and primarily would be stored and transported in vehicle gas tanks. Some additional gasoline storage may be provided in appropriately designed and labeled 1- to 5-gal containers for supplemental use as vehicle fuel. No large scale storage of gasoline is anticipated. Tetraethyl lead, an extremely hazardous material, is present in leaded gasoline (regular).

C-1.5.2 Diesel Fuel

Diesel fuel for use as a fuel would be similar to that described for gasoline. Each well location would have aboveground storage tanks containing diesel fuel during drilling operations. Tanks would be filled by a local fuel supplier. The use, transport, and storage of diesel fuel would be conducted in accordance with all relevant state and/or federal rules, regulations, and guidelines.

C-1.5.3 Natural Gas

Natural gas produced on-site would be burned to provide power for compressor stations and other ancillary facilities. Hazardous materials are known to be present in natural gas. No extremely hazardous materials are known to exist in the natural gas from the project area.

C-1.5.4 Propane

The only hazardous material known to be present in propane is propylene. No extremely hazardous materials are known to be present. Propane would be purchased from regional vendors and would be stored and transported in appropriate propane tanks. No large-scale storage of propane is anticipated.

C-1.6 GEOPHYSICAL SURVEY MATERIALS

Geophysical survey operations, which are subject to separate environmental analyses for purposes of NEPA compliance, may be conducted on portions of the project area. Materials utilized for geophysical surveys that potentially contain hazardous materials are listed in Table C-1.1. Hazardous materials potentially contained in these products would be handled according to applicable state and federal regulations.

C-1.7 PIPELINE MATERIALS

Gas produced from wells would be transported from each location through pipelines linking well locations to existing natural gas gathering systems. Industry standard pipeline equipment, materials, techniques, and procedures in conformance with all applicable regulatory requirements would be employed during construction, testing, operation, and maintenance of the project to ensure pipeline safety and efficiency. All necessary authorizing actions for natural gas pipelines would be addressed prior to installation. These actions include:

- Sublette County special use permits;
- BLM rights-of-way (ROWs) applications;
- conformance with Department of Transportation pipeline regulations (49 CFR 191-192); and
- Wyoming Public Service Commission Certificates to act as common carrier for natural gas.

Materials utilized for pipeline construction, operation, and maintenance that may contain hazardous materials are listed in Table C-1.1. Hazardous materials associated with pipeline construction, operation, and maintenance would be handled in accordance with applicable state and federal regulations.

C-1.8 EMISSIONS

Emissions from combustion engines; well construction, completion, and production; and pipeline construction, operation, and maintenance would occur as a result of this project. Hazardous and extremely hazardous materials are known to be released directly or formed secondarily (i.e., ozone) from the construction and operation of natural gas wells and associated pipelines (Table C-1.1). Extremely hazardous emission materials include nitrogen dioxide, ozone, sulfur dioxide, and sulfur trioxide. No releases of these hazardous and extremely hazardous materials are anticipated to exceed quantities allowed for in Prevention of Significant Deterioration Class II areas of the WDEQ-Air Quality Division Implementation Plan, nor are combustion emissions expected to exceed Wyoming Ambient Air Quality Standards or National Ambient Air Quality Standards. Particulate matter emissions and larger unburned hydrocarbons eventually would settle out on the ground surface, whereas gaseous emissions would react with other air constituents as components of the nitrogen, sulfur, and carbon cycles.

C-1.9 MISCELLANEOUS MATERIALS

Miscellaneous materials potentially containing hazardous substances that may be used for the proposed project are listed in Table C-1.1. Quantities of these miscellaneous hazardous materials are unknown; however, no extremely hazardous substances are known to be present in any of these materials. Miscellaneous materials would be used during well construction and production operations; well, pipeline, and equipment maintenance; and reclamation activities.

C-2.0 MANAGEMENT POLICY AND PROCEDURE

Each individual Operator would be responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials as a result of the proposed project would be in accordance with all applicable existing, or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All project-related activities involving the production, use, and/or disposal of hazardous or extremely hazardous materials would be conducted to minimize potential environmental impacts.

Each Operator is expected to comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40 CFR 117, must legally be reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended. The materials for which such notification must be given are the extremely hazardous substances listed under the *Emergency Planning and Community Right to Know* Section 302 and the hazardous substances designated under Section 102 of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, as amended. If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice must be given to the BLM's Authorized Officer and all appropriate federal and state agencies. Additionally, the Operator immediately must give notice of any spill or leakage, as defined in BLM NTL-3A, to the Authorized Officer and other such federal and state officials as required by law.

Each Operator would prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies would be available for review at the BLM Pinedale Resource Area Office in Pinedale. These plans/policies include:

- Spill Prevention Control and Countermeasure Plans;
- Spill Response Plans (oil/condensate);
- inventories of hazardous chemical categories pursuant to Section 312 of the *SARA*, as amended; and
- Emergency Response Plans.

Development operations are also required to be in compliance with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Occupational Safety and Health Act, and the Federal Clean Air Act. In addition, project operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

APPENDIX D:

WILDLIFE MONITORING/PROTECTION PLAN

WILDLIFE MONITORING/PROTECTION PLAN FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT

Prepared for

Pinedale Resource Area
and
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Rock Springs District
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May 1997

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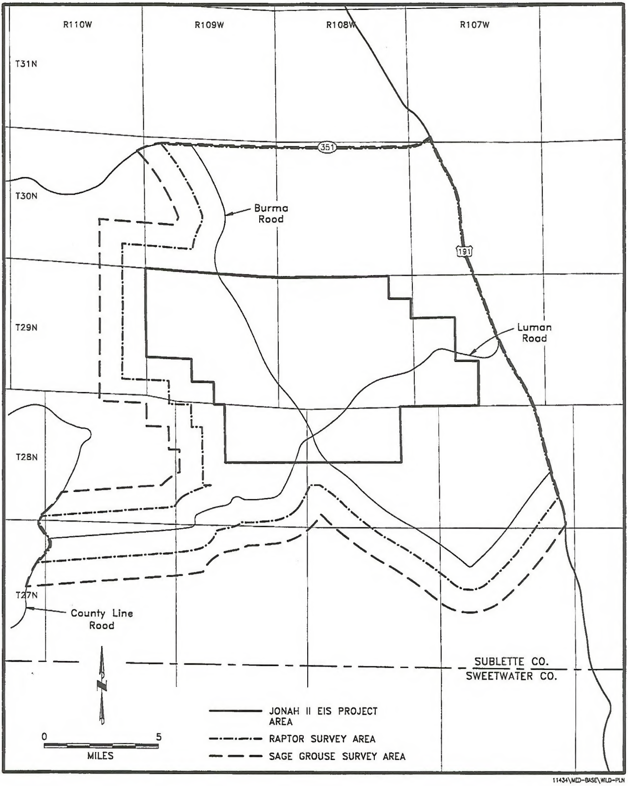
D-1.0 INTRODUCTION

This wildlife monitoring/protection plan was prepared in conjunction with the environmental impact statement (EIS) for the Jonah Field II Natural Gas Development Project, Sublette County, Wyoming. The goals of the plan are to monitor wildlife population trends on the Jonah Field II project area (J2PA) during the course of project development and operations and to avoid and/or minimize adverse impacts to wildlife present on project-affected areas. Map D-1.1 shows the location of the J2PA and associated wildlife monitoring areas. Implementation of the plan would allow land managers and project personnel opportunities to achieve and maintain desired levels of wildlife productivity and populations on the J2PA (e.g., pre-project levels) by minimizing and/or avoiding potential adverse impacts to wildlife species. In addition, the implementation of this plan would facilitate the maintenance of a diverse assemblage of wildlife populations on the J2PA simultaneous with the development of natural gas reserves.

The proposed Jonah Field II natural gas project involves the development of a maximum of 450 new well locations and associated facilities (roads, pipelines, compressor stations) on the J2PA over the next 10-15 years. The proposed life-of-project (LOP) is estimated to be from 40 to 50 years. Alternative development strategies have been proposed (i.e., Proposed Action, Maximum Well Density Alternative, Sensitive Resource Area Alternative, No Action). A complete description of the proposed project and alternatives is provided in Chapter 2.0 of the Jonah Field II EIS.

Proposed inventory, monitoring, and protection measures would be implemented under each potential development scenario (i.e., alternative), unless information revealed in the coordinated review of annual wildlife reports (see Section D-2.1.1) indicates these measures are unnecessary for wildlife protection. This wildlife plan would not be implemented under the No Action Alternative.

Implementation of the plan would begin in 1997 and continue for five years. However, the plan may be terminated at the end of any year when there is sufficient evidence that project-related impacts to wildlife populations and productivity in the J2PA have been successfully mitigated and, therefore, are negligible.



Map D-1.1 Wildlife Survey Areas, Jonah II Natural Gas Project, 1997.

D-2.0 IMPLEMENTATION PROTOCOL

This section provides preliminary wildlife inventory, monitoring, and protection protocol. Alternative protocols likely would be developed in the future in response to specific needs identified in annual wildlife reports (see Section D-2.1.1). Methods are provided for each wildlife species/category. The wildlife species/categories for which specific inventory, monitoring, and protection procedures would be applied were developed based on management agency (i.e., U.S. Bureau of Land Management [BLM], U.S. Fish and Wildlife Service [USFWS], Wyoming Game and Fish Department [WGFD]) and individual concerns identified during the preparation of the EIS (see EIS Section 1.4).

D-2.1 ANNUAL REPORTS AND MEETINGS

D-2.1.1 Reports

During the first five years of project development, Operators (i.e, McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, Western Gas Resources) would provide an annual inventory and description of all existing project features (i.e., location, size, and associated level of human activity at each feature), as well as those tentatively proposed for development within the next 12 months. This inventory would be coupled with annual wildlife inventory, monitoring, and protection data obtained for the previous year and included in annual reports. Annual reports would be prepared by an Operator-financed and BLM-approved biologist. When annual wildlife inventory, monitoring, and protection data are gathered by parties other than the Operator biologist, those parties (e.g., BLM, WGFD) would provide the data to the Operator biologist by October 15 of each calendar year. Upon receipt of these data, annual reports would be completed in draft form by the Operator-financed biologist and submitted to BLM, USFWS, and WGFD by November 15. A meeting of the aforementioned parties would be held in early December of each year to discuss and modify, as necessary, proposed wildlife inventory, monitoring, and protection protocol for the subsequent year. A final annual report would be issued by the Operators to all potentially affected individuals and groups by early February of each year. The first annual report would be submitted by February 15, 1998.

Annual reports would summarize annual wildlife inventory and monitoring results, note any trends across years, identify and assess protection measures implemented during past years, specify protection measures proposed for the upcoming year, and recommend modifications to the existing wildlife monitoring/protection plan based on the successes and/or failures of past years. In addition, sources of potential disturbance to wildlife would be identified, where practical (e.g., development activities, weather conditions, etc.). Tables D-2.1 through D-2.4 provide examples for the presentation of data within annual reports. Raw data collected each year would also be provided to management agencies (e.g., BLM, WGFD, USFWS, Wyoming Natural Diversity Database) at the request of these agencies. Annual reports would be prepared during the first five years of project development. After this five-year period, this plan would be reviewed by the BLM in consultation with the USFWS, WGFD, and Operators and would be updated and modified as necessary.

Additional reports may be prepared in any year, as necessary, to comply with other relevant wildlife laws, rules, and regulations (e.g., black-footed ferret survey reports [see Section D-2.3.2.1]).

D-2.1.2 Meetings

Meetings would be held as necessary in any given year by the Operators, WGFD, USFWS, and/or BLM in Pinedale to inform and update Operator personnel on the findings of the annual reports. Relevant wildlife laws, rules, and regulations also may be discussed, as would project-specific wildlife monitoring and protection management protocol for the upcoming year. Additional information on the nature of the wildlife present on the J2PA, potential impacts to wildlife, appropriate Operator responses to wildlife encounters to avoid or minimize impacts, and other items (e.g., species identification) may be presented at these meetings as deemed necessary and specified in annual reports.

D-2.2 ANNUAL INVENTORY AND MONITORING

Inventory and monitoring protocol would be as identified below for each wildlife species/category.

Table D-2.1 Summary of Raptor Nest Data, Jonah II Natural Gas Project, 1997.

Nest No.	Legal Location	Status	Condition	Species (if active)	Buffer Radius	# Eggs	# Nestlings	# Fledglings	Comments (e.g., Distance to Disturbance, Potential Impacts, Mitigation)

Table D-2.2 Summary of Observations of Threatened, Endangered, Candidate, and Other Species of Concern, Jonah II Natural Gas Project, 1997.

Species	Total # Obs.	Habitat Type[1]					Comments (suitable habitat, nests, etc.)	Potential Impacts/Mitigation
		BS	CP	SB	DS	P/R		

[1] Indicates presence/absence. BS = Big sagebrush; CP = Cushion plant; SB = Saltbush; DS = Disturbed; P/R = Pond/riparian

Table D-2.3 Summary of Sage Grouse Lek Data, Jonah II Natural Gas Project, 1997.

Lek No.	Legal Location	Date	Status	# Males	# Females	Distance to Disturbance/Potential Impacts/Mitigation

Table D-2.4 Summary of General Wildlife Observations, Jonah II Natural Gas Project, 1997.

Species			Habitat Type[1]					No. of Obs. by Season[2]			
Common Name	Scientific Name	No. of Obs.	BS	CP	SB	DS	P/R	Winter	Spring	Summer	Fall
Mammals											
Total											
Birds											
Total											
Reptiles/Amphibians											
Total											
Grand Total											

[1] Indicates presence/absence. BS = Big sagebrush; CP = Cushion plant; SB = Saltbush; DS = Disturbed; P/R = Pond/riparian

[2] Seasons are defined as follows: Winter = November-March; Summer = June-August; Spring = April-May; Fall = September-October

These protocol would be unchanged across development alternatives, except as authorized by the BLM. Additional surveys may be added or surveys may be omitted in future years, pending results presented in the coordinated review of annual reports. Opportunistic wildlife observations would be made throughout the year by agency and Operator personnel present on the J2PA.

D-2.2.1 Raptors

A raptor inventory of potentially affected areas (see Map D-1.1) would be conducted in April/May of 1997 to determine the location of raptor nests/territories and their activity status by an Operator-financed, BLM-approved biologist. This survey may be implemented aerially (e.g., via helicopter) or from the ground. Data collected during the survey would be recorded on Raptor Nesting Record, Raptor Observation Data Sheets, or other similar data forms (see Addendum D-A).

Additional nest productivity monitoring would occur in successive years at nests/nesting territories that are located within 1 mi of project-required disturbance areas that require repeated human presence. Productivity surveys in potentially affected areas would be conducted between March 1 and mid-July to determine nesting success (i.e., number of nestlings/fledglings). These surveys would be conducted from the ground, and attempts would be made to determine the cause, if any, of documented nest failure. Site-specific raptor nest inventories also would continue to be conducted in association with Application for Permit to Drill (APD) and Right-of-way (ROW) application field reviews.

During the first few years of survey, the approximate boundary of each raptor pair's nesting territory would be defined, if possible, and where productivity monitoring is required, it would be conducted on the nesting territory. In addition, attempts would be made to determine the general foraging territories for raptor pairs. This information is important for determining potential locations for artificial nesting structures (ANSs), if these structures are proposed for use as a protection measure (see Section D-2.3.1).

All raptor nest/productivity surveys would be conducted using procedures that minimize potential adverse effects to nesting raptors. Specific survey measures for reducing detrimental effects are listed in Call (1978) and Grier and Fyfe (1987) and include the following.

- Nest visits would be conducted as late as possible in the nesting season.
- Nests would be approached cautiously and their status (i.e., number of nestlings/ fledglings) determined from a distance with binoculars or a spotting scope.
- Nests would be approached tangentially and in an obvious manner to avoid startling adults.
- Nests would not be visited during adverse weather conditions (e.g., extreme cold, precipitation events, windy periods, hottest part of the day).
- Visits would be kept as brief as possible and, in no instance, would be greater than 10 minutes.
- All inventories would be coordinated with management agencies.
- The number of nest visits in any year would be kept to a minimum.
- All raptor nest location data would be kept confidential.

D-2.2.2 Threatened, Endangered, Candidate, and Other Wyoming Species of Concern

The level of inventory/monitoring required for threatened, endangered, candidate, and other Wyoming species of concern (TEC&WSC) would be commensurate with established protocol for the potentially affected species. Survey protocol developed in conjunction with the Biological Assessment for this project (see EIS, Appendix E) would be conducted as a component of this Wildlife Monitoring/Protection Plan. Methodologies and results of these surveys would be included in annual reports or provided in separate supplemental reports. Additionally, as TEC&WSC species are added to or withdrawn from USFWS, BLM, and WGFD lists, appropriate modifications would be incorporated into this plan and specified in annual reports.

TEC&WSC data collected during the surveys described below would be considered confidential and would be provided only as necessary to those requiring the data for specific management and/or project development needs. Data would be collected on appropriate General Wildlife Observation Data Sheets or other similar forms (see Addendum D-A).

Alternate/additional forms may be used as specified by the BLM.

D-2.2.2.1 Black-footed Ferret

Prairie dog colonies (i.e., black-footed ferret habitat) on the J2PA were mapped and burrow densities determined in spring 1996, and most prairie dog colonies on the area have sufficient burrow densities (i.e., > 8 burrows/acre) to warrant black-footed ferret surveys prior to disturbance (Anderson 1996). Additional prairie dog colonies encountered on the J2PA would be mapped and burrow densities calculated by the BLM. Colonies that meet USFWS criteria as black-footed ferret habitat (USFWS 1989a) would be surveyed for black-footed ferrets by an Operator-financed, USFWS-certified surveyor prior to BLM authorizing disturbance of these colonies. Black-footed ferret surveys would be conducted in accordance with USFWS guidelines (USFWS 1989a) and would be conducted on a site-specific basis, depending on the areas proposed for disturbance in a given year as specified in the annual report.

D-2.2.2.2 Bald Eagle, Peregrine Falcon, Ferruginous Hawk, and Golden Eagle

Inventory and monitoring protocol for bald eagle, peregrine falcon, ferruginous hawk, and golden eagle would be as described for raptors (see Section D-2.2.1).

D-2.2.2.3 Mountain Plover

Suitable mountain plover habitat (i.e., areas with vegetation less than 6 inches in height) within 0.25 mi of proposed well locations or 300 ft of proposed roads (as identified in annual wildlife reports) would be surveyed prior to disturbance by the BLM to detect the presence of plovers. Surveys would be conducted on these areas between March 15 and August 15. If plovers are not found, no additional surveys would be conducted. If plovers are discovered, observations would continue for sufficient duration to determine if mountain plover nests are present. If no nesting is discovered, no additional surveys would be conducted. If nesting is discovered on the area, surveys would be conducted on and within 0.25 mi of areas proposed for development between March 15 and July 15 no more than 14 days prior to the date that ground-disturbing activities are initiated. If development is proposed for the period of March 15 through April 15 or July 15 through August 15, a single survey would be required; however, if ground-disturbing activities are proposed for the period of April 15 through July 15, two surveys would be required. If two surveys are required, these surveys would be made at least 14 days apart, with the last survey no more than 14 days prior to the initiation of ground-disturbing activities.

D-2.2.2.4 Western Burrowing Owl

Prairie dog colonies on and within 0.5 mi of existing and proposed disturbance areas would be searched annually for western burrowing owls by the BLM during June and July to determine the extent of owl nesting on and in the vicinity of the J2PA. The number of active nest burrows on the J2PA would be identified each year. Efforts would be made to determine reproductive success.

D-2.2.2.5 Other TEC&WSC Species

Surveys for other TEC&WSC species would be conducted by the BLM in areas of potential habitat within 0.5 mi of proposed disturbance sites prior to disturbance. These surveys may be implemented in conjunction with surveys for other species or as components of APD and/or ROW application processes. If any TEC&WSC species are observed, the observations would be noted on appropriate data forms (see Addendum D-A). A list of all TEC&WSC species potentially occurring on the J2PA is provided in Table D-2.5. In addition, when and if TEC&WSC species are observed, efforts would be made to determine the activities (e.g., breeding, nesting, foraging, hunting) of the species on the J2PA. If any management agency (i.e., BLM, WGFD, USFWS) identifies a potential for concern regarding any of these species, additional inventory and monitoring may be implemented as specified in annual reports.

D-2.2.3 Sage Grouse

Annual sage grouse lek surveys would be conducted to determine lek locations and the extent of sage grouse breeding activity on potentially affected areas (see Map D-1.1). Surveys would be coordinated by the WGFD and would be conducted two times, a minimum of ten days apart, during March and April of each year, by the WGFD, BLM, and/or an Operator-financed BLM-approved biologist. Surveys may be conducted aerially or on the ground, as

Table D-2.5 Preliminary List of Threatened, Endangered, Candidate, Sensitive, and Wyoming Species of Concern Documented or Potentially Occurring on or in the Vicinity of the Jonah II Natural Gas Project Area, 1997[1].

Species		Status[2, 3]				Documented on or in Vicinity of the J2PA?[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD	WYNDD		
BLM-MANAGED SPECIES							
Peregrine falcon	*Falco peregrinus*	LE	X	X	X	Yes	UB
Whooping crane	*Grus americana*	LE	X	X	X	Yes	FT
Black-footed ferret	*Mustela nigripes*	LE	X	X	X	Yes	BS, SB, CP, DS
Bald eagle	*Haliaeetus leucocephalus*	LT	X	X	X	Yes[6]	UB
Mountain plover	*Charadrius montanus*	C	X	X	X	Yes[6]	CP, DS
Northern goshawk	*Accipiter gentilis*	SC	--	X	X	Yes[6]	FT
Ferruginous hawk	*Buteo regalis*	SC	--	X	--	Yes[6]	UB
Western burrowing owl	*Athene cunicularia hypugaea*	SC	--	--	X	Yes[6]	BS, SB, CP, DS
Big piney milkvetch	*Astragalus drabelliformis*	SC	W[7]	--	X	Yes	BS
Cedar rim thistle	*Cirsium aridum*	SC	S[8]	--	X	Yes	BS
Large-fruited bladderpod	*Lesquerella macrocarpa*	SC	S[8]	--	X	Yes	UB
Opal phlox	*Phlox opalensis*	SC	W[7]	--	X	Yes	BS, SB
Tufted twinpod	*Physaria condensata*	SC	W[7]	--	X	Yes	UB
Turkey vulture	*Cathartes aura*	--	X	--	--	Yes	UB
Osprey	*Pandion haliaetus*	--	X	--	--	Yes[6]	FT
Northern harrier	*Circus cyaneus*	--	X	--	--	Yes[6]	UB
Sharp-shinned hawk	*Accipiter striatus*	--	X	--	--	Yes[6]	FT
Cooper's hawk	*Accipiter cooperii*	--	X	--	--	Yes[6]	FT
Red-tailed hawk	*Buteo jamaicensis*	--	X	--	--	Yes[6]	UB
Rough-legged hawk	*Buteo lagopus*	--	X	--	--	Yes	UB
Golden eagle	*Aquila chrysaetos*	--	X	--	--	Yes[6]	UB
American kestrel	*Falco sparverius*	--	X	--	--	Yes[6]	UB
Merlin	*Falco columbarius*	--	X	X	X	Yes[6]	UB
Prairie falcon	*Falco mexicanus*	--	X	--	--	Yes[6]	UB
Barn owl	*Tyto alba*	--	X	--	X	Yes[6]	UB
Great horned owl	*Bubo virginianus*	--	X	--	--	Yes[6]	UB
Long-eared owl	*Asio otus*	--	X	--	--	Yes	UB
Short-eared owl	*Asio flammeus*	--	X	--	--	Yes[6]	UB

Table D-2.5 (Continued)

Species		Status[2, 3]				Documented on or in Vicinity of the J2PA?[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD	WYNDD		
ADDITIONAL USFWS SPECIES OF CONCERN							
Western boreal toad	*Bufo boreas boreas*	SC	--	X	X	Yes	P/R
Eastern short-horned lizard	*Phrynosoma douglassi brevirostre*	SC	--	--	--	Yes	UB
Northern sagebrush lizard	*Scleporus graciosus*	SC	--	--	--	Yes	BS, SB, DS
White-faced ibis	*Plegadis chihi*	SC	--	X	X	Yes[6]	FT (P/R)
Trumpeter swan	*Cygnus buccinator*	SC	--	X	X	Yes	FT (P/R)
Harlequin duck	*Histrionicus histrionicus*	SC	--	X	X	Yes	FT (P/R)
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	SC	--	--	X	Yes	BS, SB
Common tern	*Sterna hirundo*	SC	--	--	X	Yes	FT (P/R)
Black tern	*Chlidonias niger*	SC	--	X	X	Yes	FT (P/R)
Loggerhead shrike	*Lanius ludovicianus*	SC	--	--	--	Yes[6]	UB
Baird's sparrow	*Ammodramus bairdii*	SC	--	--	X	No	FT
Small-footed myotis	*Myotis ciliolabrum*	SC	--	X	--	No	UB
Long-eared myotis	*Myotis evotis*	SC	--	X	X	Yes	UB
Long-legged myotis	*Myotis volans*	SC	--	X	--	Yes	UB
Spotted bat	*Euderma maculatum*	SC	--	X	X	No	UB
Townsend's big-eared bat	*Plecotus townsendii*	SC	--	X	X	No	UB
Pygmy rabbit	*Sylvilagus idahoensis*	SC	--	X	X	Yes	BS
Allen's thirteen-lined ground squirrel	*Spermophilus tridecemlineatus alleni*	SC	--	--	X	Yes	UB
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	SC	--	X	X	No	P/R
Swift fox	*Vulpes velox*	SC	--	X	X	No	UB
ADDITIONAL WYOMING GAME AND FISH DEPARTMENT SPECIES OF CONCERN							
Common loon	*Gavia immer*	--	--	X	X	Yes[6]	FT (P/R)
American white pelican	*Pelecanus erythrorhynchos*	--	--	X	X	Yes	P/R
American bittern	*Botaurus lentiginosus*	--	--	X	X	Yes	FT (P/R)
Snowy egret	*Egretta thula*	--	--	X	X	Yes[6]	FT (P/R)
Black-crowned night heron	*Nycticorax nycticorax*	--	--	X	X	Yes[6]	Ft (P/R)

Table D-2.5 (Continued)

Species		Status[2, 3]				Documented on or in Vicinity of the J2PA?[4]	Habitat Type(s)[5]
Common Name	Scientific Name	USFWS	BLM	WGFD	WYNDD		
Long-billed curlew	*Numenius americanus*	--	--	X	X	Yes	BS, P/R
Caspian tern	*Sterna caspia*	--	--	X	X	Yes[6]	FT (P/R)
Forster's tern	*Sterna forsteri*	--	--	X	X	Yes	FT (P/R)
Yellow-billed cuckoo	*Coccyzus americanus*	--	--	X	X	No	FT
Lewis' woodpecker	*Melanerpes lewis*	--	--	X	X	Yes[6]	FT
Ash-throated flycatcher	*Myiarchus cinerascens*	--	--	X	X	Yes	FT
Scrub jay	*Aphelocoma coerulescens*	--	--	X	X	No	FT
Plain titmouse	*Parus inornatus*	--	--	X	X	No	FT
Bushtit	*Psaltriparus minimus*	--	--	X	X	No	FT
Scott's oriole	*Icterus parisorum*	--	--	X	X	No	FT
Dwarf shrew	*Sorex nanus*	--	--	X	X	Yes[6]	P/R, BS, SB
Vagrant shrew	*Sorex vagrans*	--	--	X	--	Yes[6]	P/R, BS, SB
Little brown myotis	*Myotis lucifugus*	--	--	X	--	Yes	UB
Big brown bat	*Eptesicus fuscus*	--	--	X	--	Yes	UB
Pallid bat	*Antrozous pallidus*	--	--	X	X	No	UB
Cliff chipmunk	*Tamias dorsalis*	--	--	X	X	No	BS
Pinyon mouse	*Peromyscus truei*	--	--	X	X	No	BS, SB, DS
Water vole	*Microtus richarsoni*	--	--	X	X	Yes	P/R

1 Wyoming Natural Diversity Database (WYNDD) search for Mr. Pete Guernsey (1996); U.S. Fish and Wildlife consultation letter to Mr. Pete Guernsey (1996); Wyoming Game and Fish Department (WGFD) (1997) list of species of concern; and Fertig (1997).
2 USFWS = U.S. Fish and Wildlife Service, WGFD = Wyoming Game and Fish Department, WYNDD = Wyoming Natural Diversity Database, and BLM = Bureau of Land Management.
3 LE = USFWS listed endangered, LT = USFWS listed threatened, SC = USFWS species of concern, C = USFWS candidate species, X = given special status by the agency listed (i.e., WGFD, WYNDD, and/or BLM species of concern).
4 Indicates documentation of amphibian, reptile, or bird species in Sublette County (Baxter and Stone 1980; Fertig 1997); documentation of bird species within latitude 42°, longitude 109° (Dorn and Dorn 1990; WGFD 1992; WGFD 1996b); and/or documentation of mammal species within latitude 42°, longitude 109° (WGFD 1992, 1996b) or within Sublette County (Fertig 1997).
5 P/R = pond/riparian, BS = big sagebrush, SB = saltbush, CP = cushion plant, DS = disturbed, UB = ubiquitous, FT = fly through.
6 Species has been documented breeding within latitude 42°, longitude 109° (Dorn and Dorn 1990; WGFD 1992).
7 BLM "Watch" plant species per the draft list dated March 10, 1997.
8 BLM "Sensitive" plant species per the draft list dated March 10, 1997.

deemed appropriate by the WGFD; aerial surveys would be used only to determine lek locations. If aerial surveys are conducted, financial support sufficient to cover aircraft expenses would be provided by the Operators. Leks within 2 mi of existing and proposed disturbance areas would be monitored three times annually by the WGFD and/or BLM between March 1 and May 15 to determine lek attendance. Data collected during these surveys would be provided on Sage Grouse Lek Records or other suitable forms (see Addendum D-A).

Sage grouse winter use surveys of potentially affected areas (see Map D-1.1) would be coordinated by WGFD and implemented by the BLM and/or WGFD during December through March as deemed appropriate by these management agencies, and results would be presented in the annual report. These surveys would be conducted to identify sage grouse wintering areas. Data collected during winter surveys would be provided on General Wildlife Observation Data Sheets or other suitable forms (see Addendum D-A).

D-2.2.4 General Wildlife

BLM, WGFD, and some Operator personnel on a voluntary basis would keep records of the wildlife species observed during the course of their activities on the J2PA. The information provided would include observations of wildlife species; their numbers, location, activity; and other pertinent data, as applicable and identified on the General Wildlife Observation Data Sheet presented in Addendum D-A of this Wildlife Monitoring/Protection Plan. Some of the desired information may be difficult for Operators to define (e.g., specific legal locations in U.S. Geological Survey [USGS] coordinates, species type for hard to recognize species [passerine birds and small mammals], sex). Where Operators are uncertain of the legal location for an observation, a general description of the location may be provided (e.g., 100 yards north of well #___), and in instances where species or sex information are questionable, Operators would identify the observation as such.

Comments received during scoping for the Jonah Field II EIS identified public and agency concerns regarding antelope movement across the J2PA to and from wintering areas north of the area. To further understanding of pronghorn movements on the J2PA, the WGFD would coordinate efforts to document pronghorn antelope migration periods and movement patterns and their relationship to disturbance.

D-2.3 PROTECTION MEASURES

The wildlife protection measures proposed herein have been developed from past measures identified for oil and gas developments in Wyoming. These measures may be modified in any given year as deemed appropriate by management agencies and specified in annual reports. It is assumed that as the wildlife of the J2PA are further described and impacts identified, some protection measures would be removed, whereas others may be added. Protection measures would be implemented by Operators with assistance from and/or in consultation with the BLM.

The principle protection measure for most wildlife species would be avoidance of sensitive/crucial habitats (e.g., raptor nests, sage grouse leks), where possible. However, numerous species-specific measures may be implemented. Additionally, general wildlife protection measures (see Section D-2.3.4) likely would benefit the majority of wildlife species found on and adjacent to the J2PA.

D-2.3.1 Raptors

The primary protection measure for raptor species on the J2PA would be avoidance of active nest locations during the breeding season. Active nests are defined as any raptor nest that has been used within the last three years. Depending on the timing of construction and drilling activities, all surface-disturbing activities would be restricted from February 1 through July 31 within a 0.5-mi radius of active or occupied raptor nests, except ferruginous hawk, bald eagle, or peregrine falcon nests, for which the seasonal buffer would be 1.0 mi. Exceptions to this measure may be made where raptor pairs are documented using alternate nests greater than 0.5 mi from the surface disturbance area within the same nesting territory. In addition, well locations, roads, ancillary facilities, and other surface structures requiring repeated human presence would not be constructed within 825 ft of active raptor nests (2,000 ft for bald eagles), where practical. The seasonal buffer distance and exclusion dates may vary, depending on factors such as nest activity status, species, prey availability, natural topographic barriers, and line-of-sight distances. Actual nest buffers for each active raptor nest would be established in annual reports.

Operators would notify the BLM immediately if raptors are found nesting on or within 825 ft of project facilities, and Operators would assist the BLM, as necessary, to erect ANSs, as appropriate. However, the use of ANSs would be considered as a last resort for raptor protection. If nest manipulation or a situation requiring a "taking" of a raptor nest becomes necessary, a special permit would be obtained from the Denver USFWS Office, Permit Section. Permit acquisition would be coordinated with the Wyoming State USFWS Office in Cheyenne and would be initiated with sufficient lead time to allow for development of mitigation. Required corresponding permits would be obtained from the WGFD in Cheyenne. Consultation and coordination with the USFWS and WGFD would be conducted for all protection activities relating to raptors.

If it is found that project activities could potentially be affecting raptor nesting on or adjacent to the J2PA, as determined from decreased raptor productivity or nesting or documented nest abandonment or failure, ANSs may be constructed at a rate of up to two ANSs per impacted nest, or existing, degraded raptor nests may be upgraded/reinforced to minimize potential impacts. The location, design, and other pertinent data regarding ANSs or nests proposed for upgrading would be identified in annual reports, and these ANSs would be located within the nesting territory of potentially affected raptor pairs and outside of the line-of-sight or nest buffer of actively nesting pairs, where possible. Operators would be responsible for the annual maintenance of ANSs throughout the LOP. Annual ANS maintenance activities would be completed after August 1 and prior to September 15 each year, as necessary. ANSs would be placed within the nesting territories of potentially affected raptor pairs at sites sufficiently removed from development activities to minimize or avoid potential adverse effects. All ANSs on public lands would become the property of the BLM upon completion of the project.

In cases where existing project features (e.g., well locations) are located within the nest buffers of active raptor nests, no extensive maintenance activities (e.g., workovers) would be allowed during critical periods (i.e., approximately early March through mid-June). The exact dates of exclusion would be determined by the BLM and likely would vary between nests and from year to year, depending on the species present and variations in weather, nesting chronology, and other factors.

D-2.3.2 TEC&WSC

USFWS and WGFD consultation and coordination would be conducted for all protection activities relating to TEC&WSC species and their habitats. Where possible, these actions would be specified in advance in the annual reports.

D-2.3.2.1 Black-footed Ferret

If prairie dog colonies of sufficient size and burrow density for black-footed ferrets are scheduled to be disturbed, as identified in annual reports, black-footed ferret surveys of these colonies would be conducted pursuant to USFWS decisions made during informal consultations. Survey protocol would adhere to USFWS guidelines as established in USFWS (1989a) and would be conducted by a USFWS-qualified biologist a maximum of one year in advance of the proposed disturbance. Reports identifying survey methods and results would be prepared and submitted to the USFWS and BLM in accordance with Section 7 of the Endangered Species Act of 1973, as amended, and the Interagency Cooperation Regulations. Surveys would be financed by the Operators.

If black-footed ferrets are found on the J2PA, the USFWS would be notified immediately and formal consultations would be initiated to develop strategies that ensure no adverse effects to the species. Before ground-disturbing activities are initiated in black-footed ferret habitat, authorizations to proceed must be received from the BLM, in consultation with the USFWS.

D-2.3.2.2 Bald Eagle, Peregrine Falcon, Ferruginous Hawk, and Golden Eagle

Protection protocol generally would be as described for raptors (see Section D-2.3.1). Additional measures would be applied on a species- or site-specific basis, as deemed appropriate by the USFWS and/or BLM, and specified in annual reports.

D-2.3.2.3 Mountain Plover

If a mountain plover nest is observed within survey areas (see Section D-2.2.2.3), planned development activities would be delayed at least 30 days. If a brood is discovered, planned activities would be delayed at least seven days.

D-2.3.2.4 Western Burrowing Owl

Other than the avoidance of prairie dog colonies, where practical (see Section D-2.3.2.1), and the avoidance of active raptor nests during the nesting period (see Section D-2.3.1), no additional species-specific protection measures are proposed. Additional measures may be applied if burrowing owl productivity on the J2PA and vicinity is noted to be declining. These measures would be identified in annual reports.

D-2.3.2.5 Other TEC&WSC Species

If, during surveys of areas within 0.5 mi of proposed disturbance sites (see Section D-2.2.2.5), nests or other crucial features for any TEC&WSC species are found (e.g., loggerhead shrike nests), avoidance of these features would be accomplished in consultation and coordination with the BLM, USFWS, and WGFD. Construction activities in these areas would be curtailed until there is concurrence between BLM, USFWS, and WGFD on what activities can be authorized. Activities would, in most cases, be delayed until such time that no adverse effects would occur (e.g., after fledging).

No additional protection measures would be applied for other sensitive species potentially present on the J2PA; however, it is assumed that the protocol specified below for general wildlife would benefit TEC&WSC species as well. If any management agency (i.e., BLM, WGFD, USFWS) identifies a potential for impacts to any TEC&WSC species, additional measures may be implemented as specified in annual reports.

D-2.3.3 Sage Grouse

Surface disturbance and actions that create permanent and high profile structures such as buildings and storage tanks which are suitable as raptor perches, would not occur within 0.25 mi of sage grouse leks on and adjacent to the J2PA. To protect nesting sage grouse, operators would restrict construction activities between March 1 and June 30 within a 2.0-mi radius of active sage grouse leks on suitable sage grouse nesting habitat as determined during on-site reviews of proposed development areas. In addition, if an active sage grouse nest is identified in an area proposed for disturbance, surface-disturbing activities would be delayed in the area until nesting is completed.

D-2.3.4 General Wildlife

Unless otherwise indicated, the following protection measures would be applied for all wildlife species. Additional measures primarily designed to minimize impacts to other J2PA resources (e.g., vegetation and surface water resources, including wetlands, steep slopes, etc.) are identified in EIS Section 2.4.11 and Chapter 4.0; these measures may provide additional protection for area wildlife as well. Additional actions may be applied in any given year to further minimize potential impacts to wildlife. These actions would be specified in annual reports.

All roads on and adjacent to the J2PA that are required for the proposed project would be appropriately constructed, improved, maintained, and signed to minimize potential wildlife/vehicle collisions and facilitate wildlife (most notably, antelope) movement through the J2PA. Appropriate speed limits would be adhered to on all J2PA roads, and Operators would advise employees and contractors regarding these speed limits. In addition, some existing roads on the J2PA and surrounding transportation planning area may be reclaimed (see EIS Appendix A, Transportation Plan).

No road or pipeline ROW fencing is proposed for the project; however, if ROW fencing is required, it would be kept to a minimum and the fences employed would consist of four-strand barbed wire meeting BLM guidelines for facilitating wildlife movement. Wildlife-proof fencing would be utilized only to enclose reclaimed areas where it is determined that wildlife species are impeding successful vegetation establishment. In addition, improvements to existing fences on the J2PA (most notably, the fence separating the BLM Pinedale Resource Area from the Green River Resource Area) may be made to facilitate antelope movements across the J2PA.

To enhance the use of the J2PA during dry periods, additional water sources may be developed on the area. The number, location(s), and design of these water sources would be developed in consultation with BLM, WGFD, and Operators, and would be specified in annual reports. Operators would assist WGFD and BLM in the implementation of this "water for wildlife" program on the J2PA and surrounding areas.

Potential increases in poaching would be minimized through employee and contractor education regarding

wildlife laws (see Section D-2.1.2). If violations are discovered on the J2PA, Operators would notify the BLM and WGFD immediately, and if the violation is committed by an employee or contractor, said employee or contractor would be disciplined and may be dismissed by the Operator, and/or prosecuted by the WGFD.

Additional nonspecies-specific wildlife mitigations include the following.

- Reserve, workover, and production pits potentially hazardous to wildlife would be adequately protected by netting and/or fencing as directed by the BLM to prohibit wildlife access.
- Siphons would be constructed at each reserve pit to collect, as necessary, any undesirable materials that may enter pits.
- No surface water or shallow groundwater in connection with surface water would be utilized for the proposed project.
- Firearms and dogs would not be allowed on the J2PA during working hours by BLM or Operator employees or their contractors.
- If injured wildlife are observed on the J2PA, Operator personnel would contact the BLM Pinedale Resource Area and the WGFD Pinedale office. Under no circumstances would injured wildlife be approached or handled.

D-2.4 SUMMARY

Table D-2.6 provides a summary of the monitoring and protection measures that would be applied as components of this plan.

Table D-2.6 Summary of Wildlife Reporting, Monitoring, and Protection Measures, Jonah II Natural Gas Project.

Measure	Responsible Entities	Dates
Annual reports	Operators	Draft - November 15 Final - Early February
Meetings	Operators, WGFD, USFWS, BLM	As necessary
Raptor nest inventory	Operators	April-May 1997
Raptor productivity monitoring	Operators	March-July
Black-footed ferret surveys	BLM, USFWS, Operators	As necessary
Mountain plover surveys	BLM	March 15-August 15
Western burrowing owl surveys	BLM	June-July
Other TEC&SC surveys	BLM, USFWS, Operators	As necessary
Sage grouse lek inventories	WGFD, Operators	March-April
Sage grouse lek monitoring	WGFD, BLM	March-May
Sage grouse winter use surveys	BLM, WGFD	December-March
Pronghorn antelope movement observations	WGFD	Fall, winter, spring
General wildlife observations	BLM, WGFD, Operators	Yearlong
Raptor avoidance	Operators, BLM	February-July
ANS construction	Operators, BLM	As necessary
Mountain plover avoidance	Operators, BLM	As necessary
Western burrowing owl avoidance	Operators, BLM	As necessary
Sage grouse lek/nest avoidance	Operators, BLM	March-June
General wildlife avoidance and protection	Operators, BLM, USFWS, WGFD	As necessary

D-3.0 LITERATURE CITED

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ADDENDUM D-A:

EXAMPLE DATA FORMS

GENERAL WILDLIFE OBSERVATION DATA SHEET

Month/year__________ Observer______________________ Type of survey__________ _______ Page ___ of ___

Notes ____

Date	Species	# indiv. by age and sex	Location	Habitat type	Activity/direction of movement	Comments/weather conditions

[1] Circle any uncertain data (i.e., partial counts, uncertain age or sex) or note as unknown.

RAPTOR NESTING RECORD

Nest Number________ Location______________________________ Habitat Type____________________________

Map Location

Date first observed____________________________________

Initial observer_______________________________________

Nest type____

Nest material____

Substrate____

Rim/tree height (m)_____________________________________

Nest height above ground level (m)_______________________

Elevation____

Nest exposure____

Comments____

____

____

____

USGS Quad_____________________________________

Date	Status	Species	# adults	# eggs	# young	Observer	Comments (condition, activity of individuals, etc.)

A photo of the nest location may be provided on reverse.

RAPTOR OBSERVATION DATA SHEET

Month/year__________ Observer______________________ Type of survey________________ Page ___ of ___

Notes ____

Date	Species	# indiv. by age and sex	Location	Habitat type	Activity	Comments/weather conditions

[1] Circle any uncertain data (i.e., partial counts, uncertain age or sex) or note as unknown.

SAGE GROUSE LEK RECORD

Lek Number__________ Location______________________________ Habitat Type____________________________

Map Location

Date first observed____________________________________

Initial observer_______________________________________

Slope/topography______________________________________

Elevation____

Lek exposure____

Comments____

USGS Quad_____________________________________

Date	Time	Status	# males	# females	Weather conditions	Observer	Comments

APPENDIX E:

BIOLOGICAL ASSESSMENT AND
U.S. FISH AND WILDLIFE SERVICE COMMENT LETTER

BIOLOGICAL ASSESSMENT FOR THE JONAH FIELD II NATURAL GAS DEVELOPMENT PROJECT THREATENED, ENDANGERED, AND CANDIDATE SPECIES

Prepared for

Pinedale Resource Area
and
Green River Resource Area
Rock Springs District
Bureau of Land Management
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By

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MAI Project 11434

May 1997

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E-1.0 INTRODUCTION

McMurry Oil Company, Snyder Oil Corporation, Amoco Production Company, and Western Gas Resources (hereafter referred to as the Operators) have notified the U.S. Department of the Interior (USDI), Bureau of Land Management (BLM) that they intend to expand natural gas exploration and development in an area adjacent to the existing Jonah Prospect Field, as described in the *Jonah Field II Draft Environmental Impact Statement* (DEIS). The Jonah Field II project area (J2PA) is located on lands administered by the BLM's Green River and Pinedale Resource Areas, Rock Springs District, in Sublette County approximately 32 mi southeast of Pinedale, 28 mi northwest of Farson, and 2 to 17 mi west of U.S. Highway 191 (see Maps 1.1 and 2.1 in the DEIS). The project area would include portions of Townships 28 and 29 North, Ranges 107, 108, and 109 West, and would encompass approximately 59,600 acres, all of which is federal surface/federal minerals except for 2,560 acres of state surface/state minerals and 640 acres of private surface/federal minerals.

This Biological Assessment (BA) discusses the potential effects of the proposed project on federally listed threatened, endangered, and candidate (TE&C) plant and animal species occurring on or adjacent to the J2PA and surrounding cumulative impacts area (Table E-1.1). The BA also presents recommendations to assure that the construction and subsequent operation of the proposed project would neither jeopardize the continued existence of these species nor result in the destruction or adverse modification of their critical habitats. Analysis of effects of this proposed project on federally listed TE&C species ensures compliance with the provisions of the Endangered Species Act (ESA) of 1973, P.L. 93-205 (87 Stat. 884), as amended. The U.S. Fish and Wildlife Service (USFWS) response to this BA is provided as Addendum E-A.

TE&C species are those that have been specifically designated as such by the USFWS. Threatened species are those that are likely to become endangered in the foreseeable future throughout all or a significant portion of their ranges. Endangered species are those that are in danger of extinction throughout all or a significant portion of their ranges. Candidate species (former Category 1 candidate species) are those for which the USFWS has sufficient data to list as threatened or endangered, but for which proposed rules have not yet been issued (USFWS 1995a).

Critical habitat for a TE&C species includes: 1) the specific locations within the geographical area occupied by the species at the time it is listed in accordance with the provisions of Section 4 of the ESA, on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection; and 2) specific areas outside the geographical area occupied by the species at the time it is listed, if determined by the Secretary (i.e., of the Interior, of Commerce, or of Agriculture) that such areas are essential for the conservation of the species.

Table E-1.1 Federal Threatened, Endangered, and Candidate Animal and Plant Species and Their Potential Occurrence on the J2PA, Sublette County, Wyoming.[1]

Species		Federal Status[2]	Potential Occurrence on J2PA[3]
Common Name	Scientific Name		
MAMMALS			
Black-footed ferret	*Mustela nigripes*	E	X
BIRDS			
Bald eagle	*Haliaeetus leucocephalus*	T	U
Mountain plover	*Charadrius montanus*	C	U
Peregrine falcon	*Falco peregrinus*	E	R
Whooping crane	*Grus americana*	E	X
FISH			
Bonytail chub	*Gila elegans*	E	X
Colorado squawfish	*Ptychocheilus lucius*	E	X
Humpback chub	*Gila cypha*	E	X
Razorback sucker	*Xyrauchen texanus*	E	X

1 Adapted from U.S. Fish and Wildlife Service (USFWS) (1996).

2 Federal status (USFWS 1996):

- E = Listed as federally endangered.
- T = Listed as federally threatened.
- C = USFWS Notice of Review, Category 1 Candidate. Species for which current information supports the biological appropriateness of proposing to list as endangered or threatened, but proposed rules have not yet been issued.

3 Species occurrence:

- U = Uncommon; species may be present in the J2PA, but in such low numbers or in such small and widely scattered populations that an encounter during field development and operation is unlikely. The species could be present for a significant part of the year (e.g., breeding season, summer resident) or the entire year.
- R = Rare; species may be in the J2PA for just a few days or hours (e.g., stopping over during migration), or the species has only occasionally or rarely been sighted in the J2PA. Encounters during field development and operation are very unlikely.
- X = Not probable; there has been no recent historical record of the species' occurrence in the J2PA; probability of encountering the species during field development and operation is very unlikely.

E-2.0 PROJECT DESCRIPTION

Operators propose to expand natural gas exploration and development in the J2PA, and the entire J2PA is included in the analysis for this BA. This project entails the development of natural gas resources in the J2PA beginning in 1997 and continuing for approximately 10-15 years. The estimated life-of-project (LOP) is 40-50 years. Well spacing patterns likely would vary across the J2PA and range from 640 acres (one well location per 640-acre section) to 80 acres (eight well locations per section).

The Proposed Action, No Action Alternative, and two alternatives are evaluated in this DEIS:

- the Proposed Action (450 well locations--see Section E-2.1);
- Alternative A (sensitive resource area protection alternative--see Section E-2.2);
- Alternative B (maximum well location density alternative--see Section E-2.3); and
- the No Action Alternative (see Section E-2.4).

A complete description of the development features associated with the Proposed Action and alternatives is provided in Section 2.4 of the DEIS.

E-2.1 THE PROPOSED ACTION (450 WELL LOCATIONS)

The Proposed Action is to drill and develop up to 450 well locations and related roads, pipelines, and ancillary facilities within the J2PA in addition to existing operations and currently approved proposals described in BLM (1994). Drilling would begin in 1997 and continue at the rate of approximately 30 wells/year until such time as:

- the total number of proposed wells have been drilled;
- the natural gas resources in the field have been fully developed; or
- economic conditions are such that it is no longer profitable to drill additional wells.

Existing and authorized surface disturbance from roads (including unimproved and two-track routes), well locations, pipelines, and ancillary facilities is approximately 457 acres (see Table 2.1 in DEIS). The Proposed Action would result in 2,927 acres of new surface disturbance including: 1,125 acres for 450 well locations (2.5 acres/location); 1,527 acres (180 mi) of new road construction with adjacent gathering pipelines; approximately 121 acres to widen the Burma and Luman Roads; 16 acres for up to four compressor stations (4 acres each); 5 acres for 10 water wells; and 133 acres (22 mi) for a sales pipeline (Table 2.1 in the DEIS). LOP surface disturbance resulting from the Proposed Action would be 1,086 acres and includes 152 acres of existing disturbance.

E-2.2 ALTERNATIVE A (SENSITIVE RESOURCE PROTECTION)

Alternative A involves a reduction in surface disturbance based on sensitive resource protection. Surface disturbance throughout the entire J2PA resulting from Alternative A likely would be reduced from that of the Proposed Action due to conditional surface use (CSU) restrictions applied on federal lands within a 0.5-mi area surrounding active raptor nests and sage grouse leks (4,021 acres) (see Map 2.2 in DEIS). CSU restrictions under this alternative would include the denial of all well location, road, or other construction activities that result in the establishment of surface facilities requiring repeated human presence in this 0.5-mi area. Construction that results in facilities not requiring repeated human presence (e.g., pipelines) may be authorized within CSU areas (i.e., within 0.5 mi of active leks and nests). This CSU restriction has been established based on public comments that indicate current BLM seasonal use restrictions may not adequately protect sage grouse leks and raptor nests. Directional drilling from locations away from CSU areas may be used to access natural gas reserves beneath the CSU areas. In addition, no major project activities (e.g., construction, drilling, workovers) would be allowed during crucial raptor and sage grouse breeding and nesting periods (e.g., February 1 through July 31 for raptors and March 1 through June 30 for sage grouse) within 1.0 mi of these features under this alternative.

It is assumed that reductions in surface disturbance and associated activities proximal to active leks and nests would result in reductions in impacts (both direct and indirect) to these resources. Since the locations of active nests and leks likely would change over time, nests and leks would be considered active if they have been used within the last 3 years, and the BLM, WGFD, and/or the Operators would conduct annual raptor and sage grouse lek surveys of the area to determine nest and lek activity status.

Since approximately 4,021 acres of the J2PA is within 0.5 mi of known active raptor nests and sage grouse leks, it is assumed that surface disturbance in the J2PA would be reduced by approximately 6% (i.e., rounded to 420 new well locations) (see Table 2.1 in DEIS). Alternative A, therefore, would result in an estimated maximum of 2,750 acres of new initial disturbance and 878 acres of new LOP surface disturbance. Total long-term disturbance on the J2PA for the LOP (including 152 acres of existing disturbance required for the project) would be 1,030 acres.

E-2.3 ALTERNATIVE B (MAXIMUM DENSITY OF 4 WELL LOCATIONS/SECTION)

Under Alternative B, a maximum of four new well locations per section (160-acre spacing) would be allowed throughout the J2PA, unless it can be shown that higher densities can be developed without increased surface disturbance and/or human activity levels. However, in areas where federal gas reserves potentially are being depleted from wells located on state sections, higher well densities would be authorized. The use of condensate, drilling water, produced water pipelines, co-mingling facilities, and/or centralized facilities, which temporarily would increase overall ground surface disturbance, may, in some instances, be preferable, since their use could result in a decrease in the level of human activity along access roads and at well locations, thereby reducing indirect habitat loss. In addition, remote sensing devices could be installed at well locations to further reduce human activity levels.

Since a maximum of approximately 327 new well locations (i.e., four locations per section in all areas of the J2PA where this location density has not yet been reached) would be developed under Alternative B, new and LOP surface disturbance would be reduced from that of the Proposed Action (see Table 2.1 in DEIS). An estimated maximum of 2,262 acres of new initial disturbance and 724 acres of new LOP surface disturbance would be required. Total long-term disturbance on the J2PA for the LOP (including 152 acres of existing disturbance required for the proposed project) would be 876 acres.

E-2.4 NO ACTION ALTERNATIVE

CEQ regulations for implementing National Environmental Policy Act of 1969 (NEPA) require that a "No Action" alternative be considered in all environmental impact statements (EISs), "even if the agency is under a court order or legislative command to act. This analysis provides a benchmark, enabling decision makers to compare the magnitude of environmental effects of the action alternatives. It is also an example of a reasonable alternative outside the jurisdiction of the agency which must be analyzed" (46 Code of Federal Regulations [CFR] 18026, March 23, 1981). Under the No Action Alternative, the BLM would deny further natural gas development on federal lands in the J2PA as currently proposed by the Operators, while allowing existing land uses to continue. The decision to select the No Action Alternative for this project is available to the BLM through denial of individual Applications for Permit to Drill (APDs); however, the right to drill and develop somewhere within the leasehold cannot be denied by the Secretary of the Interior because valid leases have been issued which specifically grant the lessee (or his designated operator) the *"right to drill for ... extract, remove and dispose of all oil and gas deposits"* from the leased lands subject to the terms and conditions of the respective leases. This alternative provides a bookmark enabling decision makers to compare the magnitude of incremental effects of the action alternatives.

The Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, and restrictions can be imposed on the lease terms (see *Cooper Valley Machinery Works, Inc. vs. Andrus*, 474 F. Supp. 189, 191; D.D.C. 1973; 653 F. 2nd 595; D.D.C. 1981; *Natural Resources Defense Council vs. Berland*, 458 F. Supp. 925, 937; D.D.C. 1978), but the Secretary cannot deny development of the lease. Therefore, denial of the current development proposal is not a denial of all natural gas development in the area.

For the purposes of analysis in this EIS, choice of the No Action Alternative would mean that the Proposed Action and other action alternatives would not be implemented and that existing land uses would continue in the J2PA. This land use would include completion of the already-approved Jonah Prospect Field (BLM 1994b). The Decision Record for the Jonah Prospect Field approved the drilling of 40 wells, with approximately 24 mi of new access road, approximately 24 mi of gathering pipeline, construction of two sales pipelines (27.8 mi total length), and a wareyard and compressor station

expansion. There are no other developments proposed for the area at this time, nor are any anticipated in the reasonably foreseeable future, although it is acknowledged that, given the natural gas reserves apparently available within the J2PA, proposals to recover those resources are likely to be developed sometime in the future. If and when proposals are formalized, they would be subjected to analysis under NEPA.

Most leases in the J2PA contain various stipulations addressing surface disturbance, steep slopes, wildlife, and other matters of concern. These stipulations would allow the BLM to preclude development in certain areas (e.g., where slopes exceed 25%) or at certain times of the year (e.g., to protect raptor nests) if operations cannot be acceptably mitigated. However, there is no stipulation, such as a No Surface Occupancy, that would allow the BLM to preclude drilling operations everywhere on a lease at all times of the year. If any one of the stipulations cannot be acceptably implemented and impacts mitigated, than an exception would not be granted. A decision, therefore, of no action, as authorized by the leases, would only be considered, given one of the following conditions.

- If there were no acceptable means of mitigating significant adverse impacts to stipulated surface resource values, then this would trigger denial of the APD and require consideration and analysis of another alternative(s). Effectively, exception(s) to one or more of the lease stipulations would not be approved.
- If the USFWS concluded that the Proposed Action and alternatives would likely jeopardize the continued existence of threatened plant and/or animal species, then the APD and lease development may be denied in whole or in part.

This BA will help to determine whether the proposed project meets any of these conditions.

E-3.0 METHODS

A list of TE&C animal and plant species that potentially occur on or in the vicinity of the J2PA was compiled from several sources, including a letter from the Wyoming State Supervisor's Office of the USFWS (1996), the Wyoming Game and Fish Department (WGFD) Wildlife Observation System records (WGFD 1996b), and the Nature Conservancy's Wyoming Natural Diversity Database (WNDDB) (WNDDB 1996). All TE&C species identified from these sources are discussed in Chapter E-5.0 of this BA.

Information pertaining to the natural history and distribution of the TE&C animal and plant species potentially occurring on the J2PA was gathered from the above sources and from published literature. Site-specific information pertaining to TE&C species occurrence and potential impacts would be part of the APD and right-of-way (ROW) application processes.

E-4.0 PROJECT-WIDE MITIGATION MEASURES FOR TE&C SPECIES

This section describes measures that would be utilized to avoid, minimize, or mitigate potential impacts to TE&C species due to project development. These measures apply to the Proposed Action and the two action alternatives. Exceptions to project-wide mitigation measures may be made on a case-by-case basis by the BLM if a thorough analysis determines that the TE&C species for which the measure was developed would not be impacted. Further site-specific mitigation measures would be identified during APD and ROW application review processes. To ensure compliance with mitigation measures presented in this BA and in APD and ROW applications, the Operators would provide a qualified individual (i.e., Field Environmental Coordinator) to be available during construction/drilling operations. The Field Environmental Coordinator would consult with the BLM on a case-by-case basis as necessary during field development.

All of the proposed mitigation/environmental protection measures identified in this chapter would be implemented on all J2PA lands. Development activities on all lands would be conducted in accordance with all appropriate federal, state, and county laws, rules, and regulations.

Mitigation measures would include, but are not limited to the following.

1. Well locations, access roads, pipelines, and ancillary facilities would be selected and designed to minimize disturbances to areas of high wildlife habitat value, including wetlands and riparian areas.

2. Areas with high erosion potential and/or rugged topography (i.e., steep slopes, dunes, floodplains, unstable soils) would be avoided, where possible.

3. Removal or disturbance of vegetation would be minimized through construction site management (e.g., by utilizing previously disturbed areas, using existing ROWs, designating limited equipment/materials storage yards and staging areas, scalping), and Operators would adhere to all reclamation guidelines presented in the Reclamation Plan for this project (see Appendix B of the DEIS).

4. The Operators, in consultation with representatives from BLM, WGFD, USFWS, and other interested groups such as area livestock operators, would adhere to the Wildlife Monitoring/Protection Plan for this project (see Appendix D of the DEIS). The plan would be incorporated into the Operators' field operations manual or handbook, a copy of which would be kept on-site and in the office.

5. To minimize wildlife mortality due to vehicle collisions, Operators would advise project personnel regarding appropriate speed limits in the project area, and roads would be reclaimed as soon as possible after they are no longer required. Some existing roads in the project area may be closed and reclaimed by the Operator as directed by the BLM. Potential increases in poaching would be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offending employee or contractor would be disciplined and may be dismissed by the Operators and/or prosecuted by the WGFD.

6. Reserve, workover, and evaporation/production pits potentially hazardous to wildlife would be adequately protected (e.g., netted, fenced) to prevent access by migratory birds and other wildlife.

7. USFWS and WGFD consultation and coordination would be conducted for all mitigation activities related to raptors and TE&C species (and their habitats), and all permits required for movement, removal, and/or establishment of raptor nests would be obtained. In addition, the following raptor nest avoidance measures would be applied.
   - Well locations, pipelines, and associated roads would be selected and designed to avoid disturbances to raptor nest sites.
   - Raptor nest surveys would be conducted within a 1.0-mi radius of proposed surface use or activity areas if such

activities are proposed to be conducted between February 1 and July 31.

- All surface-disturbing activity (e.g., road, pipeline, well pad construction, drilling, completion, workover operations) would be seasonally restricted from February 1 through July 31 within a 0.5-mi radius of all active raptor nests, except ferruginous hawk nests, for which the seasonal buffer would be 1.0 mi. (An active raptor nest is defined as a nest that has been occupied within the past 3 years.) The seasonal buffer distance and exclusion dates applicable may vary, depending on such factors as the activity status of the nest, species involved, prey availability, natural topographic barriers, line-of-site distance(s), and other conflicting issues such as cultural values, steep slopes, etc. Maintenance activities would be allowed on existing well locations.

8. Additional mitigations for nesting raptors would be designed on a site-specific basis, as necessary, in consultation with the BLM, USFWS, and WGFD. The Operators would notify the BLM immediately if raptors are found nesting on project facilities and would assist the BLM as necessary to erect artificial nesting structures.

9. Firearms and dogs would not be allowed on-site during working hours. The Operators would enforce existing drug, alcohol, and firearms policies.

10. To minimize wildlife mortality due to vehicle collisions, the Operators would establish and enforce appropriate speed limits on the J2PA, and to protect plant populations and wildlife habitat, project-related travel would be restricted to established project roads; no off-road travel would be allowed, except in emergencies.

11. Wildlife-proof fencing would be utilized on reclaimed areas if it is determined that wildlife species are impeding successful vegetation establishment.

12. ROW fencing associated with this project would be kept to a minimum, and if necessary, fences would consist of four-strand barbed wire meeting BLM specifications for facilitating wildlife movement.

13. Potential impacts to fisheries would be minimized by using proper erosion control techniques (e.g., water bars, jute netting, rip-rap, mulch). Construction within 500 ft of open water and 100 ft of intermittent or ephemeral channels would be avoided, where possible. Channel crossings for roads and pipelines would be constructed during the period of lowest flow (i.e., late summer or fall). All necessary crossings would be constructed perpendicular to flow. No surface water or shallow groundwaters in connection with surface waters would be utilized for the proposed project.

14. Operators would finance site-specific surveys for TE&C and other sensitive plant species prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species (BLM Directive USDI-BLM 6840). These surveys would be completed by a qualified botanist as authorized by the BLM, and this botanist would be subject to BLM's special status plant survey policy requirements. Data from these surveys would be provided to the BLM, and if any TE&C or other sensitive plant species or habitats are found, BLM recommendations for avoidance or mitigation would be implemented. Relocation of project facilities would be made to avoid TE&C or other sensitive plant species and/or their habitat, where possible. If avoidance is not possible, consultation with the USFWS would be initiated.

15. Herbicide applications would be prohibited within 500 ft of known TE&C or other sensitive plant populations.

16. Surveys for TE&C and other sensitive animal species would be implemented by the BLM and/or a qualified BLM-authorized biologist during on-site inspections of proposed ROWs and well locations prior to disturbance. Surveys would focus on species known to occur on the J2PA, as well as those potentially occurring in the area. If TE&C

or other sensitive animal species are found on the area, construction activities would be delayed and the BLM and USFWS would be consulted to determine appropriate avoidance and/or protection measures. Habitats where TE&C or other sensitive animal species are likely or are known to occur would be avoided where possible.

17. Mountain plover surveys would be conducted by a qualified biologist in accordance with USFWS guidelines. The survey procedures would include the following.
    - Visual observation of the area within 0.25 mi of proposed well locations and 300 ft of proposed access routes would be made to detect the presence of plovers. All plovers located would be observed long enough to determine if a nest is present.
    - Surveys would be conducted no more than 14 days prior to the date actual ground-disturbance activities begin. If two surveys are required, they would be made at least 14 days apart, with the last survey no more than 14 days prior to the start-up date.
    - The number of surveys required to clear a site for mountain plovers prior to beginning a planned activity depends on the start-up date, as shown below:

Date of Planned Activity	No. Surveys Required
March 15 - April 15	1
April 15 - July 15	2
July 15 - August 15	1

    - If an active plover nest is found in the survey area, the planned activity would be delayed at least 30 days. If a brood is observed, activities would be delayed at least 7 days.

18. Proposed construction sites not examined for prairie dogs during past surveys would be examined prior to surface-disturbing activities to confirm the presence or absence of prairie dog colonies. Confirmation would be made of white-tailed prairie dog colony/complex size, burrow density, and any other data indicating whether the criteria established in the USFWS (1989a) guidelines for black-footed ferret habitat are met. If prairie dog colonies are found, a qualified biologist would attempt to locate all project components to avoid direct impacts to the colony. If this is not possible, surveys of prairie dog colonies (and for ferrets where required by the USFWS) would be conducted in accordance with USFWS guidelines and requirements. This information would be provided to the USFWS in accordance with Section 7 of the ESA, as amended, and the Interagency Cooperation Regulations.

E-5.0 SPECIES ACCOUNTS

This chapter presents a discussion of the status, habitat, potential effects, and mitigation for TE&C animal and plant species that may occur in the J2PA and the adjacent areas. A summary of the potential effects and mitigations is presented in Table E-5.1.

Threatened and endangered animals that could occur in the vicinity of the J2PA include black-footed ferret, bald eagle, peregrine falcon, and whooping crane. In addition, four species of endangered fish species--Colorado squawfish, humpback chub, bonytail chub, and razorback sucker--occur downstream of the J2PA in the Colorado and Green River drainage below Flaming Gorge Dam. Mountain plover, a candidate species, also may occur within the J2PA.

E-5.1 BLACK-FOOTED FERRET

E-5.1.1 Current Status and Habitat Use

The black-footed ferret, a federally endangered species, was once distributed throughout the high plains of the Rocky Mountain and western Great Plains regions (Forrest et al. 1985). Prairie dogs are the main food of black-footed ferrets (Sheets et al. 1972), and few black-footed ferrets have been historically collected away from prairie dog colonies (Forrest et al. 1985). Black-footed ferrets were considered extinct until a small population was discovered near Meeteetse, Wyoming, in 1981. Following outbreaks of distemper, surviving black-footed ferrets were brought into captivity and a captive breeding program was initiated (USFWS 1988). Black-footed ferrets were reintroduced in the Shirley Basin of central Wyoming in 1991; this reintroduction effort continues with the aid of annual supplemental releases. The USFWS has designated special management areas to monitor the experimental populations (USFWS 1995b); the J2PA does not overlap with any of these areas.
The likelihood of the existence of a wild black-footed ferret population is considered almost nonexistent, but still must be considered possible. Black-footed ferrets depend on prairie dogs for food and shelter and have never been found outside of prairie dog habitat.

E-5.1.2 Potential Effects

At present, it is anticipated that there would be no impact to this species due to the Proposed Action or alternatives because no black-footed ferrets are known to occur in the area. Five prairie dog towns exist within and adjacent to the J2PA (Table E-5.2, Map E-5.1); four are large enough and have a high enough burrow density to be considered potential black-footed ferret habitat. However, no evidence of black-footed ferret occupation has been documented in the J2PA (Straley 1994; WGFD 1996b; WNDDB 1996), and it is unlikely that black-footed ferrets currently inhabit the area.

The proposed project would likely have only negligible additional impacts, if any, to the cumulative effects on black-footed ferret habitat from oil and gas development, ranching, hay production, and transportation and on prairie dogs from pest control and recreational shooting.

E-5.1.3 Mitigation Measures

If prairie dog colonies PDT-1, PDT-2, PDT-3, or PDT-4 (see Table E.5.2 and Map E.5.1) are to be disturbed by the proposed project, a search per USFWS (1989a) guidelines would be made on a site-specific basis to determine whether or not black-footed ferrets are present in the colony prior to surface disturbance. If black-footed ferrets are discovered in the J2PA, the USFWS would be consulted to determine the specific procedures necessary to protect the animals under established guidelines. To minimize disturbance within prairie dog colonies, project-required facilities would be located outside of prairie dog colonies, where possible.

E-5.2 BALD EAGLE

E-5.2.1 Current Status and Habitat Use

The bald eagle is a federally threatened species that requires cliffs, large trees, or sheltered canyons associated with concentrated food sources (e.g., fisheries or waterfowl concentration areas) for nesting and/or roosting areas (Edwards 1969; Snow 1973; Call 1978; Steenhof 1978; Peterson 1986). Bald eagles forage over wide areas during the non-nesting season (i.e., fall and winter) and scavenge on animal carcasses such as pronghorn, deer, and elk. Bald eagles were recently downlisted from a federally endangered status.

Table E-5.1 Summary of Potential Effects and Mitigations for Federal Threatened, Endangered, and Candidate Species and Their Habitats On and Adjacent to the J2PA, Sublette County, Wyoming.

Species	Level of Impact to Species[1]	Level of Impact to Habitat[1]	Mitigation Measures
Black-footed ferret	1; not likely to be present	1; potential habitat only	Black-footed ferret clearance surveys would be conducted per USFWS guidelines; disturbance to prairie dog colonies (i.e., potential black-footed ferret primary resource) would be minimized.
Bald eagle	1; uncommon visitor	1; nest disturbance unlikely; potential for some displacement from foraging habitat, but overall disturbance to such habitat would be negligible	If bald eagle roosts or active nest are found, no surface activity/occupancy would be allowed within 1 mi of active roosts or nests during periods of use.
Mountain plover	2; birds may be displaced from disturbed areas	3; possible loss of nesting habitat in cushion plant communities	Plover searches would be conducted; nesting birds would not be disturbed; construction activities may be delayed during nesting period.
Peregrine falcon	1; uncommon visitor	1; no known potential nesting habitat available in area; negligible disturbance to foraging habitats	If nests are found in the area, no activity or surface disturbance would be allowed within 1 mi of active nests during nesting season.
Whooping crane	1; uncommon visitor	1; habitat not present	None.
Bonytail chub	1; not present	1; habitat not present; no surface water withdrawal in Green River watershed	Standard wetland, erosion, and aquatic habitat protection measures (see DEIS, Section 2.4.11).
Colorado squawfish	1; not present	1; habitat not present; no surface water withdrawal in Green River watershed	Standard wetland, erosion, and aquatic habitat protection measures (see DEIS, Section 2.4.11).
Humpback chub	1; not present	1; habitat not present; no surface water withdrawal in Green River watershed	Standard wetland, erosion, and aquatic habitat protection measures (see DEIS, Section 2.4.11).
Razorback sucker	1; not present	1; habitat not present; no surface water withdrawal in Green River watershed	Standard wetland, erosion, and aquatic habitat protection measures (see DEIS, Section 2.4.11).

[1] Level of impact with project-wide mitigation--a relative measure of the intensity or "seriousness" of project impacts.
1 = is not likely to adversely affect listed species.
2 = is not likely to jeopardize candidate species.
3 = possible adverse effects to candidate species.

Table E-5.2 Estimated Prairie Dog Town Size, Burrow Density, and Burrow Occupancy for Each of the Five Prairie Dog Towns Identified within the J2PA in 1996.[1]

Prairie Dog Town Number	Estimated Town Size[2]	Estimated Average Burrow Density[3]	% Burrows Active[4]	Prairie Dogs Observed
PDT-1	396 acres	46 burrows/acre	18%	0
PDT-2	324 acres	26 burrows/acre	32%	4
PDT-3	896 acres	34 burrows/acre	27%	0
PDT-4	1,546 acres	34 burrows/acre	27%	1
PDT-5	62 acres	0.8 burrows/acre[5]	20%	1

[1] Adapted from Anderson (1996).
[2] Based on aerial mapping of burrow concentrations within the J2PA.
[3] Based on two random samples collected in each prairie dog town (PDT-1 through PDT-4).
[4] Based on observations of active burrows in each individual sample plot.
[5] A total of fifty burrows were counted within the boundaries of PDT-5.

No bald eagle nests or winter roosts are known to occur in the J2PA; the lack of suitable nesting or winter roosting habitats within the J2PA precludes its use for such activities by bald eagles. Fourteen bald eagle sightings (10 adults, 2 juveniles, and 2 unclassified) have been made within and adjacent to the J2PA (WGFD 1996b), although no bald eagles have been documented in the area since 1984. Observations occurred during November and January, which is consistent with the fact that they winter and migrate along the Green River. They also have been observed in the Farson-Eden area (BLM 1994b).

E-5.2.2 Potential Effects

Migrating bald eagles and those wintering along the Green River occasionally may use the J2PA for foraging; however, such use is likely intermittent and for relatively short periods. Given this intermittent use and the lack of nesting and roosting habitat on the J2PA, it is anticipated that there would be no impact to this species from the Proposed Action or alternatives.

Cumulative impacts resulting from oil and gas development, urban expansion, and roads would probably be negligible; some additional foraging habitat would be removed, but large areas remain available to eagles. Also, all developments (including the proposed project) would avoid winter roosts and active nests, further minimizing disturbance to the species.

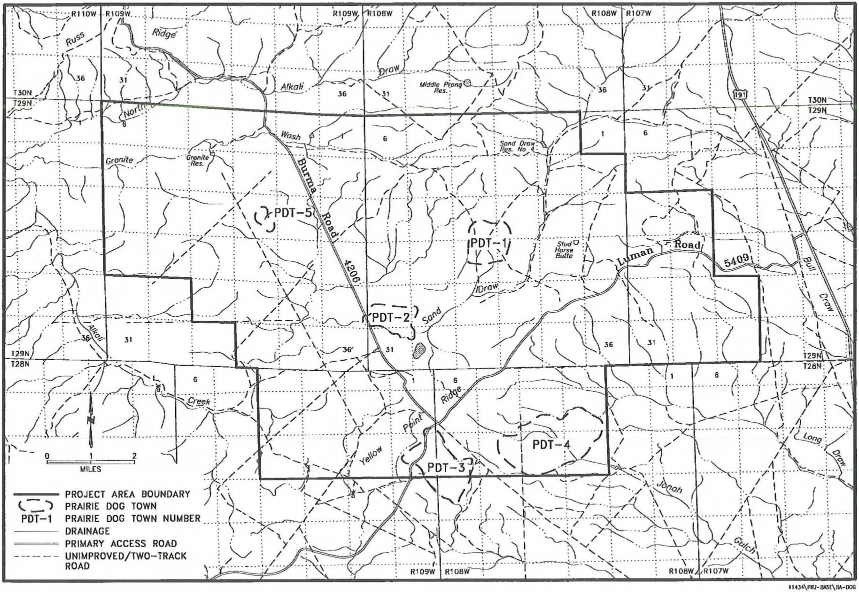
E-5.2.3 Mitigation Measures

In the unlikely event that bald eagle roosting areas are found within the J2PA, a No Surface Occupancy restriction would be applied to a 1-mi buffer zone around winter roosts, and the area would be closed to surface-disturbing activities (e.g., construction, drilling) from November 1 through April 1. If an active bald eagle nest is found within the J2PA, no activity or surface disturbance would be allowed within a 1-mi radius of the nest between February 1 and July 31.

E-5.3 MOUNTAIN PLOVER

E-5.3.1 Current Status and Habitat Use

The mountain plover is a candidate species inhabiting the high, dry short-grass plains east of the Rocky Mountains (Dinsmore 1983). The focus of breeding activity appears to be northeastern Colorado (Graul and Webster 1976). Parrish et al. (1993) noted that mountain plover nests in northeastern Wyoming were found in areas of short (<4 inches) vegetation on



Map E-5.1 Prairie Dog Colony Locations, J2PA, Sublette County, Wyoming, 1996.

slopes of less than 3%; any short grass, very short shrub, or cushion plant vegetation type could be considered nesting habitat. In Colorado, the mountain plover diet is composed of 99.7% arthropods, with beetles, grasshoppers, crickets, and ants the most important food items (Baldwin 1971). Breeding bird surveys between 1966 and 1987 show an overall decline in the continental population of mountain plovers (U.S. Forest Service [USFS] 1994a). Surveys completed in 1991 indicate that only 4,360 to 5,610 mountain plovers remain on the North American continent (USFS 1994b). Probably the most important reason for the decline of the mountain plover is the degradation in the quality of wintering habitats (e.g., southern Texas, California) (Knopf 1994). Loss of breeding habitat due to cultivation and prey base declines resulting from pesticide use are also threats to mountain plover survival (Wiens and Dyer 1975). However, cattle often maintain the open blue grama/buffalo grass habitat favored by mountain plovers, so livestock grazing may benefit the species (Klipple and Costello 1960).

Mountain plovers have not been observed within the J2PA or adjacent areas (Straley 1994; WGFD 1996b). Vegetation in the J2PA is dominated by low density stands of Wyoming big sagebrush grasslands, with some areas--especially in the eastern portion--vegetated with saltbush or cushion plant-dominated land (BLM 1987b; Reiners and Thurston 1996).

The cushion plant community--which is characterized by the near absence of sagebrush and low overall vegetative cover and includes squarestem phlox, spoonleaf milkvetch, goldenweed, and Hooker sandwort--would be suitable habitat for mountain plover breeding and foraging, so there is potential for them to occur within the J2PA (Dorn and Dorn 1990), although cushion plant communities are uncommon in the J2PA.

E-5.3.2 Potential Effects

Current observation data indicate that mountain plover are rare or absent from the J2PA and, thus, disturbance of the limited cushion plant habitat would not likely adversely affect this species. However, if mountain plover do use the available habitat in the area, disturbance of this habitat may displace some nesting pairs. Studies and survey data show mountain plover to be generally tolerant of disturbance (USFS 1994a, 1994b).

Although disturbance due to oil and gas development, urban developments, ranching, hay production, and transportation has removed an unknown portion of potential mountain plover nesting habitat, it is unlikely that the extent of this habitat removal has jeopardized plover reproduction due to the continued availability of this habitat in the region. Disturbance associated with oil and gas and other developments is dispersed throughout the region; therefore, displaced plovers would likely have adequate alternate habitats for foraging and nesting. Surface disturbance resulting from the proposed project would slightly increase cumulative impacts to mountain plovers, but such impacts are likely to remain negligible for the foreseeable future.

E-5.3.3 Mitigation Measures

If construction within suitable mountain plover habitat (i.e., cushion plant communities or other areas with low-growing vegetation) is planned between March 15 and August 15, surveys for nesting mountain plovers (i.e., a nest and/or defending pairs of adult mountain plovers) would be implemented prior to disturbance (see Chapter E-4.0, Item 17). Surveys of proposed ROWs and well locations would be conducted as components of ROW application and APD review processes. If an active mountain plover nest is found in the survey area, construction activities would be delayed at least 30 days and until such time that the birds would not be disturbed. If a brood is observed, activities would be delayed at least seven days. Surveys would not be conducted for construction activities planned for the period August 16 through March 14.

E-5.4 PEREGRINE FALCON

E-5.4.1 Current Status and Habitat Use

A federally endangered species, the peregrine falcon nests on tall cliffs, usually within 1 mi of a stream or river or extensive brush or woodlands; these habitats provide concentrated food sources and open areas in which to hunt (Snow 1972; Call 1978). Peregrine falcons nest among substantial rock outcroppings (usually southern exposure) in small caves or on overhanging ledges large enough to accommodate three to four full-grown nestlings (Wilderness

Research Institute 1979). They feed almost exclusively on birds, particularly waterfowl, which are associated with riparian zones and large bodies of water.

There is no evidence that peregrine falcons regularly utilize habitats in the vicinity of the J2PA. Peregrine falcons use the Green River as a spring and fall migration corridor, and captive-raised birds have been released in the upper Green River Basin near Pinedale. No known peregrine falcon nests occur within the J2PA (Anderson 1996), nor have any peregrine falcons been reported in the area (Straley 1994; WGFD 1996b). The absence of suitable cliffs within the J2PA precludes peregrine falcon nesting.

E-5.4.2 Potential Effects

Peregrine falcons are probably a rare visitor within and adjacent to the J2PA; therefore, it is expected that implementation of the Proposed Action or alternatives is not likely to adversely affect this species.

E-5.4.3 Mitigation Measures

In the unlikely event that an active peregrine falcon nest is found within or immediately adjacent to the J2PA, no activity or surface disturbance would be allowed within 1 mi of the nest between February 1 and July 31.

E-5.5 WHOOPING CRANE

E-5.5.1 Current Status and Habitat Use

A federally endangered species, the whooping crane inhabits moist to wet meadow grasslands, irrigated native and introduced meadows, sedge meadows, and marshes, where it feeds on a variety of plants and animals (WGFD 1992). All recorded observations of whooping cranes in Wyoming have occurred in the western part of the state; these birds are probably part of the Gray's Lake fostering project (WGFD 1992).

Whooping cranes use the Green River as a spring and fall migration corridor; however, no suitable habitat occurs in the J2PA. No whooping cranes have been observed within the J2PA, and the likelihood of their presence is extremely low.

E-5.5.2 Potential Impacts

Since whooping cranes do not occur within the J2PA, the Proposed Action and alternatives are not likely to adversely affect this species. Similarly, there would be no increase in cumulative impacts to whooping crane or its preferred habitat due to the proposed project.

E-5.6 FISH

Four species of endangered fish species--bonytail chub, Colorado squawfish, humpback chub, and razorback sucker--are present in the Green/Colorado River System downstream of the J2PA.

E-5.6.1 Current Status and Habitat Use

The bonytail chub, Colorado squawfish, humpback chub, and razorback sucker are federally endangered species, and all four species occur downstream from the J2PA in the Colorado and Green River drainage below Flaming Gorge Dam (USFWS 1987; Tyus and Karp 1989; Matthews 1990). Although once abundant throughout both of these river systems, all four species are now limited to reaches of river that are either relatively undisturbed or controlled to provide appropriate flows. Reservoir impoundments and water diversions are the main threats to these species. None of these species occur within or adjacent to the J2PA.

E-5.6.2 Potential Effects

The nearest perennial streams to the J2PA with significant fishery resources are the New Fork and Green Rivers, 4-8 mi west of the area, and no surface water withdrawal from these streams is proposed. Therefore, the Proposed Action or alternatives are not likely to adversely affect these endangered fish species.

E-5.7 PLANTS

No TE&C plant species are known to occur within or adjacent to the J2PA (WNDDB 1996); therefore, potential impacts (including cumulative impacts) to these plant species would likely be negligible, especially given adherence to the following mitigation measures.

- All potential habitat for TE&C plant species to be disturbed would be surveyed for TE&C plant species prior to disturbance.
- If TE&C plant populations are discovered they would be avoided, if possible.
- If avoidance is not feasible, other mitigation measures, approved by the USFWS and the BLM, would be implemented.

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ADDENDUM E-A:

U.S. FISH AND WILDLIFE SERVICE
BIOLOGICAL ASSESSMENT COMMENT LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
4000 Morrie Avenue
Cheyenne, Wyoming 82001

ES-61411
MEJ/W.02(jonah.con)

March 13, 1997

Memorandum

To: Arlan Hiner, Rock Springs District, Bureau of Land Management, Rock Springs, Wyoming

From: Acting Field Supervisor, Ecological Services, Cheyenne, Wyoming

Subject: Comments on Biological Assessment for the Jonah II Natural Gas Project and Wildlife Management Plan (Appendix C of the Preliminary Draft Environmental Impact Statement for Jonah Field II Natural Gas Development Project)

Thank you for the opportunity to review the subject documents. Based upon my staff's review of both documents and telephone conversations with Bob McCarty of the Bureau of Land Management's (Bureau) Pinedale Resource Area, I offer the following comments.

I commend the Bureau for taking a proactive approach to minimizing potential impacts to wildlife through development of the Wildlife Management Plan (Plan). I understand there will be some changes to the Plan based on input received during your February 11 meeting. Mary Jennings of my staff indicated to me that most of the proposed changes do not significantly change the nature of protection afforded sensitive species. The Bureau's commitment to survey for the presence of sensitive species prior to disturbance and avoid impacts to those sensitive species found in the project vicinity should preclude most impacts.

Based upon the information provided in the Biological Assessment and implementation of the Wildlife Management Plan, I concur with your assessment that the project, as described, is not likely to affect the endangered black-footed ferret (*Mustela nigripes*), peregrine falcon (*Falco peregrinus*), whooping crane (*Grus americanus*), the threatened bald eagle (*Haliaeetus leucocephalus*), or the downstream listed fish. Additionally, I concur with your determination that the project, as described, is not likely to affect the candidate mountain plover (*Charadrius montanus*) or raptors nesting in the vicinity. If the scope of the project is changed, or the project is modified in a manner that may result in an effect to listed species, or any endangered or threatened species are observed in the area, please contact this office so that we may work together to protect these important resources.

I appreciate the Bureau's efforts to involve my staff early in this project's planning process. I believe Mary's inclusion in the planning process facilitated a cooperative approach to conservation of these species and allowed us to gain a better understanding of the constraints within which the operators must operate. I look forward to more cooperative efforts of this nature. I also appreciate your efforts to ensure the conservation of threatened and endangered species, as well as migratory birds. If you have any questions, please contact Mary Jennings of my staff at the letterhead address or phone (307) 772-2374, extension 32.

Pedro Ramirez

Pedro Ramirez, ~~Jr.~~

cc: Director, WGFD, Cheyenne, WY
Nongame Coordinator, WGFD, Lander, WY

APPENDIX F:

CULTURAL RESOURCES AND HISTORIC OVERVIEW

CULTURAL RESOURCES AND HISTORIC OVERVIEW

F-1.0 CULTURAL RESOURCES

Cultural resources, which are considered under the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act of 1979 (ARPA), are the nonrenewable remains of past human activity. The archaeological record of the Jonah Field II project area (J2PA) has been partially examined through surveys, test excavations, examination of ethnographic materials, consultation with modern Native American people, archival sources, and the historic record. Euro-American exploration and settlement in the area is understood by historic and archival records, information provided by local ranchers, and informant interview. The J2PA is rich in prehistoric resources (though they are poorly understood), but contains fewer historic period sites. The historic period sites predominantly relate to open range ranching, stock grazing, and wagon road passage.

Prior to fall 1996, less than 50 sites had been recorded on the J2PA during an equivalent number of cultural resource inventory projects. In November and December 1996, Operators conducted a geophysical project covering portions of the J2PA. This project involved a cultural resource inventory, and 74 new sites were located and recorded (Kail and Sudman 1997). These cultural resource data have added substantially to our knowledge of the area's prehistory.

F-1.1 SITE TYPES

Prehistoric site types known or suspected for the J2PA include prehistoric campsites, housepits, lithic scatters, kill/butchering sites, floral processing locales, sacred sites, extensive lithic procurement locales (see Section F-1.5), Traditional Cultural Properties, limited activity sites, and various rock alignment sites. Rock alignment sites include vision quest locales, stone circle sites such as tipi rings (three have been recorded), Medicine Wheels, and cairns. No drivelines are currently known, but the vicinity of Sites 48SU1327 and 48SU1328 is suggestive. While no human burials, petroglyphs, or pictograph sites currently are known, the geomorphology of the area is conducive to the presence of these most sensitive site types. The preliminary work conducted in the J2PA suggests high site density, complex geomorphology, and a different cultural character of the prehistory as compared to other, better known regions of the Green River Basin.

F-1.2 NATIVE INDIAN SENSITIVE SITES AND TRADITIONAL CULTURAL PROPERTIES

In the late nineteenth century, the J2PA was used predominantly by the Shoshone Tribe, though the Bannock, Ute, and other tribes frequented the Upper Green River. In prehistoric times, this picture is clouded, as tribal distinctions are difficult, if not impossible, to determine. Both prehistoric sites and more modern Native American use sites are sensitive, or can be considered Traditional Cultural Properties.

Sites and properties within this class are protected by numerous laws, such as the Native American Graves Protection and Repatriation Act, the American Indian Religious Freedom Act, and Executive Orders. Human burials, rock alignment sites, petroglyphs, steatite procurement locales, and modern-day Native American use, extraction, or religious sites are considered sensitive or sacred to modern Native Americans. One such site is already identified (48SU2194), and others are known from the J2PA (e.g., 48SU2215). Consultation with potentially affected Native American Tribes concerning the identification and management of Traditional Cultural Properties and other sensitive sites in the J2PA began in 1996, was curtailed by the onset of winter, and is scheduled to resume in spring 1997.

F-1.3 CHRONOLOGY

The earliest securely documented human occupations in North America are associated with diagnostic (temporally distinct) projectile points of the Clovis and Folsom Traditions. Clovis and Folsom sites have been radiocarbon dated to between 12,000 and 10,500 years before present (YBP). These Paleoindian sites represent early human adaptation to Late Pleistocene, post-glacial environmental conditions. Past emphasis on the "Big Game Hunting Tradition" (i.e., a reliance on Pleistocene megafauna for subsistence) may have been overstressed (personal communication, January 1997, with Kevin Thompson, Archaeologist, Western Wyoming College). Studies of Paleoindian sites continue to fascinate archaeologists, and the new trend in paleoenvironmental reconstruction of the late Pleistocene/early Holocene environments is welcome.

Early Paleoindian occupations are known from just south of the J2PA. Sites 48SU389, 48SU907, 48SU908, and 48SU909 record extensive prehistoric occupations associated with an assumed perennial watersource. Recorded in the 1970s and rerecorded by the State of Wyoming in the 1980s, the site complex has produced Folsom materials and Paleoindian artifacts in the Hell Gap, Agate Basin, Scottsbluff, and Cody Complexes, as well as numerous Archaic and Late Prehistoric period artifacts, including a bison bone bed, groundstone, and other artifacts. Paleoindian occupations spanning a 12,000 to 8,000 YBP period are suggested at this large and significant site complex.

The first documented Paleoindian presence within the J2PA is recorded at Site 48SU1421. Here, Late Paleoindian diagnostic artifacts in the Lanceolate and Medicine Lodge Creek/Lovell Constricted Series were found. The "Jimmy Allen" Lance point tentatively dates the site to about 9,000 YBP. A Pryor Stemmed Point suggests an 8,500 YBP occupation. Associated with a campsite adjacent to an ancient playa lake, the site setting is duplicated at several locales within the J2PA. There is potential for use of this site for paleoenvironmental reconstruction. Additional Paleoindian sites in the J2PA likely occur, such as Site 48SU2230 (recorded in 1996), though such sites are not abundant. Extensive prior artifact collecting makes location of temporally diagnostic material difficult.

By about 8,000 YBP, postglacial environmental conditions began to reflect a more modern setting. Pleistocene megafauna such as mammoth, prehistoric bison, camel, and early horse became extinct. Human occupation sites reflect this shift, and archaeologists refer to the subsequent 6,000 years of prehistory as the Archaic Period. Figure F-1.1 depicts several different interpretations of Archaic Period chronology. The Metcalf (1987) scenario drew from the Exxon LaBarge EIS project to the south and west of the J2PA; Wheeler et al.'s (1986) similar chronology reflects excavations at the Exxon Shute Creek Plantsite. The McKibbin et al. (1989) version reflects work in Sweetwater County, Wyoming, at the Black Butte Coal Mine, similar to that of McNees et al. (1994).

Finally, archaeologists at Western Wyoming College (WWC) continue to refine southwestern Wyoming's chronology based on the most recent data and a recognition that Late Paleoindian sites may indeed mirror "Archaic" lifestyles. Rather than exclusively big game hunters, Paleoindians early on may have developed a detailed knowledge of the environment and the seasonal availability of floral and faunal resources--a hunting/foraging/collecting subsistence strategy. The resultant settlement pattern would resemble an annual cycle or "seasonal round" tapping into different resources in different locales, when available.

Sites dating to the Archaic Period (roughly 8,000 to 2,000 YBP) are numerous in the J2PA. These sites are temporally divided into the Great Divide Phase, the Green River/Opal Phase, the Pine Springs Phase (roughly equivalent to the McKean Technocomplex in the northern Great Plains [Frison 1991]), and the Deadman Wash Phase (equivalent to the Late Archaic on the Plains). The Uinta Phase marks the introduction of the bow and arrow into southwestern Wyoming and, later, the production of ceramics. These cultural innovations mark the traditional end of the Archaic Period.

One site (Site 48SU1754) on the J2PA was located and salvaged in a joint effort by Operators and the Bureau of Land Management (BLM). Hearths, lithics, tools, and butchered and processed mammal bone were recovered from the excavations. Radiocarbon assay documented an occupation of 3,590 $\pm$ 60 YBP, a Pine Springs Phase/McKean Technocomplex site. Site 48SU1754 represents the only site in the J2PA that has been subject to controlled excavations, and the site is considered eligible for the National Register of Historic Places (NRHP).

Other Archaic-aged campsites like Sites 48SU1328, 48SU1561, 48SU1562, 48SU1751, 48SU1778, and 48SU1779 are commonly identified. These sites usually date to the Pine Springs and Deadman Wash Phases of the Archaic and produce McKean Technocomplex (Site 48SU1328) and Late Archaic Period (Site 48SU1751) dart points and numerous lithic tools. The Archaic dart point recovered from Site 48SU1751 was manufactured from obsidian, a volcanic glass that can be easily sourced via X-ray florescence techniques to the exact parent obsidian flow. Obsidian source analysis (Thompson et al. 1993) is proving to be important in discerning ancient trade patterns and population movement throughout the

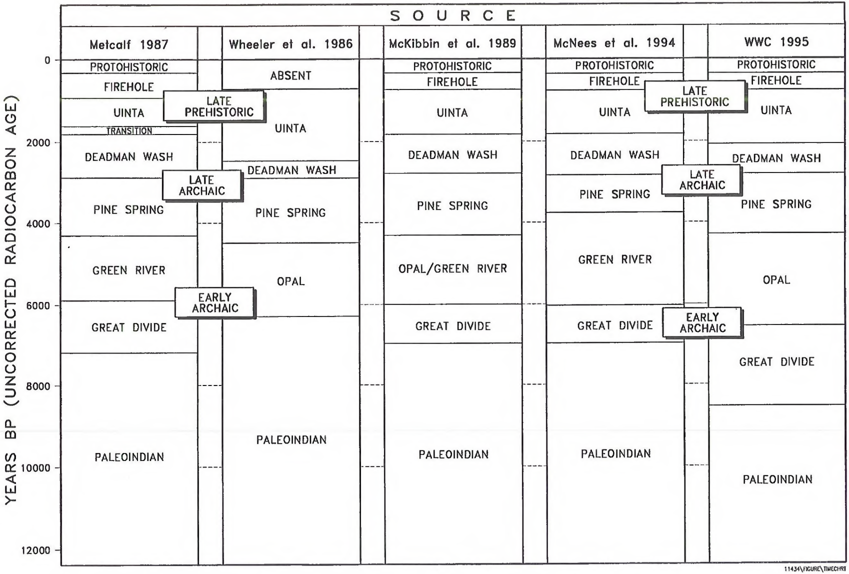

Figure F-1.1 Cultural Chronology Framework with Revisions, Jonah Field II Project, Sublette County, Wyoming, 1997.

Intermountain region. Sites within the J2PA area will undoubtedly play an important part in this study.

Sites dating to the Late Prehistoric Period, Uinta and Firehole Phases (about 1,800 to 200 YBP), are probably the most numerous. Recent inventory efforts recorded approximately 70 new sites, many of which date to the Late Prehistoric period. Sites like Site 48SU1563 have produced both Rose Springs Series arrow points (a diagnostic Uinta Phase marker) and groundstone, suggesting both hunting and vegetal food collecting as subsistence strategies. Sites 48SU2189, 48SU2198, and 48SU2204 contain similar Uinta Phase material.

An important site containing prehistoric Intermoutain ware ceramics is Site 48SU1443, located in the J2PA. Here, sherds of brown-gray pottery containing sand (or grit) tempering may relate to similar ceramics recovered from the Wardell Site, located to the north. The identification of prehistoric ceramics on sites anywhere within the Green River Basin is unusual and adds to the site's significance. Ceramic analysis can shed light on shared cultural affiliation with adjacent groups, such as the Fremont regions within Utah to the west and south or the sedentary villagers to the south and east in Colorado. Distinctions between Uinta Phase peoples and the later Firehole Phase occupants can be drawn by ceramic analysis.

Stone circle sites like those recorded at Sites 48SU2194 and 48SU2215 represent preserved dwelling or residence sites that suggest a modicum of sedentary (or seasonal) existence. These sites, though currently undated, frequently are Late Prehistoric in age and are good candidates for containing ceramics in their assemblages. Stone circle sites are considered sensitive by some modern-day Native Americans.

One site, Site 48SU968, was also subject to a small salvage effort. Two hearths were excavated, but noteworthy was the recovery of portions of a steatite bowl (personal communication, January 1997, with Scott McKern, consulting archaeologist). Steatite was aboriginally quarried in the adjacent Wind River mountains (Vlcek 1993) and represents an unusual resource, subject to transportation or trade with adjacent prehistoric populations. The recovery of steatite on sites removed from the mountains is rare, but not unknown in the J2PA (personal communication, n.d., with Pete Olsen, local rancher). Steatite use is more commonly documented on Late Prehistoric and protohistoric sites, though Archaic aged use is documented. Steatite is also considered a sacred material by some modern-day Native Americans.

F-1.4 GEOMORPHOLOGY

Geomorphological studies that examine the relationship among geology, soils, topography, and vegetation are important to archaeologists because most significant prehistoric sites are located within specific soil matrices, the history of which contribute to archaeological site integrity, the integrity of cultural deposits, and the post-depositional history of the site. These factors are critical for understanding the nature, integrity, and preservation potential of the archeological resources in the J2PA. Specialists in the field are often referred to as geoarchaeologists.

The geology and soils of the J2PA are described in Sections 3.2.2 and 3.2.6 of the Jonah Field II environmental impact statement respectively. Geologic and soils descriptions and mapping have important cultural resource applications. For example, aeolian deposits (sand dunes) (see Map 3.1) in the region often contain buried archaeological sites (Monte-Leckman complex; Hateron-Garsid complex; Spool, Ouard, and San Arcacio Variant complex; and San Arcacio-Saguache association soils). Further, Monte-Leckman soils, which are located on alluvial fans and along major drainages, and San Arcacio-Saguache soils, which occur on old floodplains, fans, and terraces (see Table 3.5 and Appendix A), both have high potential to contain buried cultural resource sites.

A recent trend in assaying cultural resource potential at the regional level involves integrating geoarchaeological information from a diversity of locales within the Green River Basin. The major regional oil and gas fields (Moxa Arch, Fontenelle, LaBarge, Wamsutter) have been a target for geoarchaeologists, due to the intensive surface management in these fields, and geomorphologic data relating to climatic shifts has emerged. Eckerle (1996) and Miller (1996) are synthesizing these data in part to determine the influence of climatic shifts on prehistoric settlement patterns within the Green River Basin. Geoarchaeological studies are lacking for the J2PA, and a further understanding of the geoarcheaology of the area will aid in cultural

resource management and the avoidance of inadvertent impacts.

F-1.5 ARCHEOLOGICAL LANDSCAPES

Two geomorphic conditions that directly relate to the archaeology of the J2PA are noteworthy. They involve the surficial expression of lithic source material useful for prehistoric stone tool manufacturing. Weathered quartzite cobbles (Site 48SU1334) and nodules of a gray, medium- to high-quality chert (Wilkins Peak Chert, Site 48SU337) are commonly located on the surface throughout the area. Prehistoric occupants utilized this material in stone tool manufacture, heating rocks for food preparation, and hearths. In 1992, the term "Yellow Point Archaeological Landscape" (Site 48SU1334) (Enders 1992) was applied to the casual use and lithic reduction of secondary deposits of quartzite cobbles in the vicinity of Yellow Point Ridge. Since this artifact class represents an elemental aspect of prehistoric resource exploitation and is easily understood by prehistorians, expressions of the Yellow Point Archaeological Landscape are not eligible for NRHP inclusion (i.e., this cultural resource is by definition nonsignificant).

While attempting to apply a similar strategy to recording the surficial expressions and lithic procurement of Wilkins Peak Chert (Site 48SU337), a somewhat more complex situation arose. Early recognized by investigators in the area (Reed 1974; Love 1976; Hakiel 1982), procurement of Wilkins Peak Chert seems to co-occur with other prehistoric artifact classes, such as utilized flakes, campsite debris, features, and formal tools (Nelson and Nelson 1994). Utilization of Wilkins Peak Chert may not represent as elemental an aspect of prehistoric exploitation as first thought. First, the chert is found as both primary outcrops and secondary deposits, with operating geology not fully understood. Second, the material is found amidst site types of greater complexity. Finally, insufficient inventory has occurred in areas where Wilkins Peak Chert is found. The initial proposal to categorically recognize Wilkins Peak Chert lithic procurement as nonsignificant was rejected by the Wyoming State Historic Preservation Office (SHPO). Nonetheless, a 1995 field examination of select areas resurrected this approach, and it will be pursued in the near future.

F-2.0 HISTORIC OVERVIEW OF THE UPPER GREEN RIVER REGION OF WYOMING

F-2.1 EARLY EXPLORATION

Early fur traders and trappers were the first Euro-Americans to penetrate and explore the Upper Green River region between present-day Pinedale and LaBarge, Wyoming, and by the 1830s, the South Pass route along the Oregon Trail was utilized to access the region. Captain Bonneville traveled over South Pass in 1832, and this was the first time wagons were used to traverse the pass. Nathaniel Wyeth led an expedition west over South Pass to the fur trade rendezvous on Green River in 1834 (Chittenden 1935; Gowans 1975; Johnson 1984; Todd 1986). Missionary activity spawned the earliest migration of emigrants west along the newly established trail when the Whitmans and Spaldings traveled over the Oregon Trail in 1836 (Coutant 1899; Hine 1984). In 1840, Jesuit missionary Pierre-Jean De Smet passed over the Oregon Trail and arrived at the rendezvous held on Green River near Horse Creek, where he held a Mass introducing Catholicism to the Shoshone and Flathead Indians gathered there with the traders and trappers (Gowans 1975; Larson 1984; Jording 1992).

Captain John C. Fremont and guide Kit Carson led the first scientific expedition by the U.S. Topographical Engineers into present Wyoming (Goetzman 1959; Larson 1984). As part of a diplomatic plan to open the Oregon region to settlement by mapping an emigrant road west, Fremont also explored the upper Green River and the Wind River Mountains. The results of the expedition, while supplying less scientific results than hoped for, succeeded in focusing the American psyche on the Far West and its settlement. In the 1850s, the Sublette and Lander Cutoffs were blazed to shorten the Oregon Trail route from South Pass across western Wyoming. No historic trails are present on the J2PA.

F-2.2 EARLY SETTLEMENT

Some of the first permanent settlement in the upper Green River region occurred along Fontenelle Creek, approximately 30 mi southwest of the J2PA (Stone 1924; Holden 1928). Prior to 1882, herds of cattle and sheep were driven through the area from Oregon to Nebraska, and local herds were pastured in the mountain valleys during the summer months, then driven east of Green River into the Little Colorado Desert for winter grazing (Holden 1928).

Settlers continued to arrive in the upper Green River Basin to settle along the tributaries of the Green River. Farther north, the first settler on Horse Creek was a man named Daniel. A post office was established at the mouth of Horse Creek on the Green River which was named for him, and the small town of Daniel grew (Stone 1924; Holden 1928).

In 1879, Daniel Budd and Hugh McKay brought 750 head of cattle into what is called the Piney Country in the vicinity of present Big Piney. Budd and his son opened a store and established a post offiyce some years later that was named Big Piney, thus establishing the future town of Big Piney in what would become Sublette County (Stone 1924; Larson 1978). Following the survey of the public lands in the vicinity of the J2PA, numerous settlers filed on land holdings, fences were built, and irrigation ditches laid out in every valley from Fontenelle Creek to Big Piney (Holden 1928).

The number of cattle continued to increase in the Green River Basin during the early 1880s. However, the severe winter of 1888-1889 caused many ranchers to switch to sheep exclusively or to diversify with both cattle and sheep.

Sometime around the turn of the century, the town of Pinedale emerged on Pine Creek and became an important community amidst the sprawling cattle country on the upper Green River and its tributaries. The first post office was erected in May 1899, about 0.25 mi south of the present-day townsite, and served as the basis for the new community. The town's unofficial establishment dates to 1904, when a few hewn log buildings emerged in a sagebrush flat near the original post office. The town boasted of a newspaper, the *Pinedale Roundup*, by September 1904, and Pinedale was incorporated in 1912. With the addition of two new counties in 1921, Pinedale became the Sublette County seat, besting Big Piney in the contest by a small margin of votes (Stone 1924; Urbanek 1988; Rosenburg 1990). During the next few decades, Pinedale served as the community center for a sparsely settled countryside whose economic basis remained focused on livestock production coupled with an emerging dude ranch industry.

As communities like Big Piney and Pinedale were established (Rosenberg 1982, 1986), a wagon link with

the railhead in Rock Springs was essential. Beginning in the 1880s, the Rock Springs to New Fork Wagon Road (Site 48SU1408) carried freight, mail, and supplies to the inhabitants of the Upper Green River Basin (Vlcek 1995). This vital link (and its sister freight road, the Opal Wagon Road) carried virtually all of the imported goods and supplies not locally produced, and these goods were used by virtually everyone in what was to become Sublette County. The Wagon Road not only had a commercial function, but stops along the route served to give place names to an otherwise desolate landscape. Ten Trees, The Wells, Mud Hole, and Sand Springs became real places and Farson developed into a community. Because the Rock Springs to New Fork Wagon Road played a critical function in settling the region, it is recognized as an NRHP eligible Expansion Era trail. Use of the wagon road continued until the paving of the Rock Springs to Pinedale Road (Site 48SU1281) in the 1920s (Gardner and Johnson 1991).

The exact location of the Rock Springs to New Fork Wagon Road in the vicinity of the J2PA is unknown; however, it is assumed to be on the eastern edge of the area, near U.S. Highway 191.

F-2.3 IRRIGATION AND AGRICULTURAL SETTLEMENT

Raising livestock in the northern Green River Basin has shaped the image and influence of the region, its origins dating back to the 1870s and 1880s. The history of livestock associations in the region are almost as old. Beginning with the creation of the Big Piney Roundup Association following the harsh winter of 1889-1890, the Upper Green River Cattle and Horse Association evolved to care for livestock as their numbers increased within the region. The current Upper Green River Cattle Association (UGRCA) has seasonally trailed or drifted cattle up and down the Green River since its creation in 1925 from the former association. Over the decades, this seasonal movement from one grazing range to another has become known as the Green River Drift. Cooperative activities of the UGRCA have evolved from simply caring for livestock herds during seasonal drives to new pasture during the early twentieth century to working with government agencies (e.g., U.S. Forest Service [USFS], BLM) in better managing the use of the land and protecting natural resources. UGRCA has had an important role in sustaining a viable ranching culture that has become a tradition in the Upper Green River Basin (Sommers 1994).

The livestock industry brought only sparse settlement to the Green River Basin. Agricultural development of Wyoming's arable lands was necessary to provide the impetus for growth during the first decade of statehood, and irrigation was the key component to successful agriculture (Hoyt 1878). The Green River Basin had a potential water supply, but the disadvantages included poor soils and high elevations, which severely limited the types of crops that could be produced.

Passage of the Carey Act in 1894 provided federal and state aid to irrigation projects and gave promoters and settlers alike the opportunity to undertake ambitious projects to convert sagebrush-covered benchlands into farms.

Several areas of the upper Green River Basin were suitable for irrigation under the Carey Act, and early agriculture in the area was probably limited to irrigating hay meadows and for domestic garden production along the tributaries of Fontenelle, LaBarge, and Piney Creeks (Holden 1928).

In 1883, an unknown engineer conceived the idea that the Big Sandy region was suitable for irrigated agriculture (Wright and Wright 1975), and permits for irrigation were first issued in 1886 (U.S. Department of the Interior [USDI] 1981). In 1906, the Eden Irrigation and Land Company was organized and incorporated under the laws of Wyoming (Wright and Wright 1975), and in 1907, the Eden Irrigation and Land Company constructed the Eden Dam on the Big Sandy River, creating Eden Reservoir. According to a newspaper article in the *Rock Springs Miner*, settlers arrived in the spring of 1908 and established the communities of Eden and Farson. The Eden Dam project was finished in 1914, and about 30 farmers utilized water from the system to irrigate crops of oats, wheat, barley, grass hay, alfalfa, and garden produce (USDI 1981).

The Green River itself was the focus of irrigation by several entities in the early 1900s. In 1908, permits were issued to the Green River Irrigation Company to construct the Green River Canal to divert water from the Green River above the mouth of Fontenelle Creek in order to irrigate lands between Green River and the Big Sandy River. It was estimated that up to

97,474 acres could be irrigated by this canal (Johnston 1909). By 1909, surveys were completed for a second canal to divert water from the west side of the Green River to reclaim 50,000-60,000 acres of land northwest of the town of Green River, and a third canal was considered to divert water from the Green River near the mouth of Horse Creek in the vicinity of Pinedale (Johnston 1909).

Expectations for the Carey Act fell short; however, with passage of the Reclamation Act of 1902, a new era of land use began with the formation of a new federal agency--the Reclamation Service (Bureau of Reclamation after 1923). In 1940, President Roosevelt approved a plan to develop and rehabilitate the Eden irrigation system under the water conservation provision of the Interior Department Appropriation Act of 1940, and the majority of work was completed by December 1959 (USDI 1981). The original system was augmented by the construction of the Big Sandy Dam and Reservoir 10 mi north of Farson. Ninety-four mi of lateral canals currently supply water to participating farmers. Livestock production is the mainstay of the area, and the principal crops include wheat, oats, barley, alfalfa, grass hay, and pasture (USDI 1981).

The Seedskadee project--part of the Colorado River Storage Project in the upper Green River Basin--provides "storage and regulation of the flows of the Green River for power generation, municipal and industrial use, fish, wildlife, and recreation" (USDI 1981). Fontenelle Dam and its powerplant and reservoir are the key components of this project. The dam is an earth-filled structure located on the Green River 24 mi southeast of LaBarge (USDI 1981). The Seedskadee National Wildlife Refuge is an important part of the project that was created in 1965 to provide habitat for waterfowl. The refuge begins 6 mi below Fontenelle Dam and extends 35 mi downstream (USDI 1981).

F-2.4 ENERGY RESOURCE INDUSTRIES

While the agricultural and livestock potential of the Green River Basin was being realized, simultaneous developments were being made in the energy resource industries. Settlement in the Green River Basin at the beginning of the twentieth century remained sparse, and initial oil and gas discoveries were minimal except in the upper Green River region near LaBarge, Big Piney, and Pinedale. Coal deposits, while plentiful in the region north of Evanston, were minimal or nonexistent in the upper Green River Basin.

It was the twentieth-century industrial demand for petroleum products that had the greatest economic impact on the upper Green River Basin. Influenced by national and international political events, economic conditions, and perhaps most importantly by the advent of the mass-produced, affordable automobile, Wyoming's oil and gas industry rose to prominence in the early decades of the twentieth century (Larson 1978).

Oil seeps and springs were probably known to exist by Native Americans in the Green River Basin; however, the extent and type of aboriginal use, if any, is not understood at present (Veatch 1907). It may be no coincidence that the historic California, Oregon, or Mormon Trails passed oil seeps to allow their utilization by the westbound emigrants (Metz 1986). Oil and gas reserves of commercial potential were discovered during the first decade of the twentieth century in the vicinity of LaBarge Creek, approximately 25 mi southwest of the J2PA and 40 mi north of Opal. Studies of the surface geology resulted in the discovery of the current LaBarge Oil Field in 1924, which was part of the 1920s Wyoming oil boom. (Espach and Nichols 1941; Wyoming Geological Association 1957; Biggs and Espach 1960). By January 1938, approximately 85 wells produced 1,100 barrels of oil per day, and six gas wells produced 35 million cubic ft per day (mmcfd) of natural gas. Unitization occurred in April 1949, and by 1960, 245 wells had been drilled in the LaBarge Field, and the oil was shipped 39 mi through a 4-inch pipeline to Opal, Wyoming.

The Big Piney Gas Field lies north of the LaBarge Field and includes North Big Piney, South Big Piney, Dry Piney, and Paff-Quealy Fields. The discovery well was completed in 1938; however, development of the field as a primary gas producer did not occur until September 9, 1952, when a well blew out in Section 28 of T28N, R113W and produced 75 mmcfd for 10 days before it could be capped and cemented. Following this occurrence, the area was developed as a gas field (Biggs and Espach 1960). In 1955, a 16-inch pipeline was constructed to Opal, Wyoming, and by 1957, gas production from 44 wells yielded 1.9 mmcfd (Biggs and Espach 1960).

The Pinedale Gas Field lies northeast of the Big Piney Field, and the town of Pinedale is located near the northern end of one of the largest anticlines in the state. In 1939, the first well was drilled, and in February 1955 a well was completed with daily production of 2.3 mmcfd from the Fort Union Formation. By 1956, five gas wells had been completed; however, no gas was produced except for testing and field use (Biggs and Espach 1960).

The Big Piney and LaBarge Fields have been enlarged since 1960 (Roberts 1989; BLM 1990b), and production levels for natural gas from the combined LaBarge, Big Piney, and Pinedale Fields are among the highest in the state (BLM 1987a). These fields figure prominently in the future development of Wyoming's natural gas reserves.